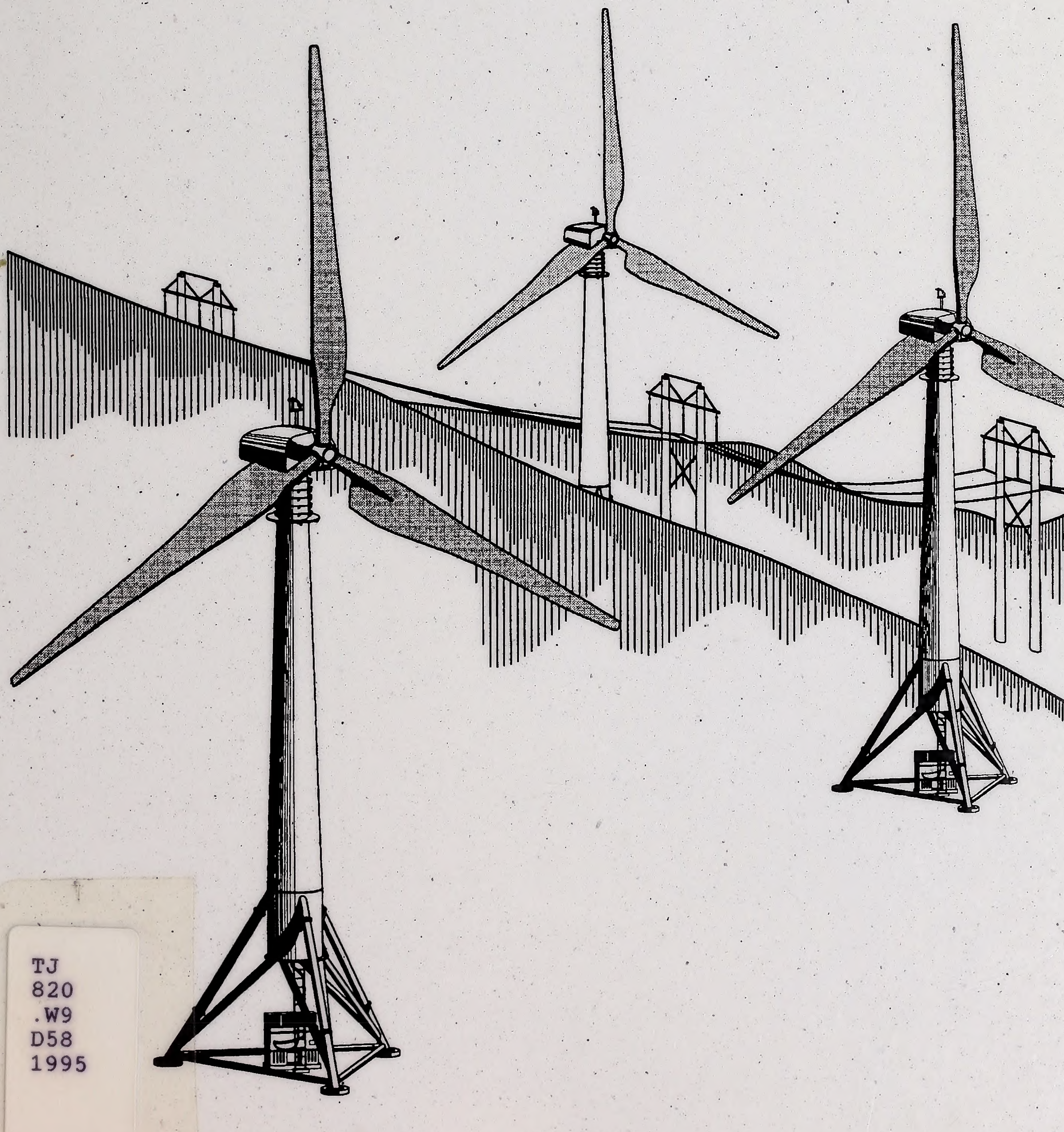
U.S. Department of Interior
Bureau of Land Management
Rawlins District

January 1995

DRAFT
KENETECH/PacifiCorp Windpower Project Environmental Impact Statement



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DES-95-2

DRAFT ENVIRONMENTAL IMPACT STATEMENT
KENETECH/PACIFICORP WINDPOWER PROJECT
CARBON COUNTY, WYOMING

Prepared for

Great Divide Resource Area
Rawlins District
Bureau of Land Management
Rawlins, Wyoming

By

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Laramie, Wyoming
MAI Project 1071

January 1995

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE KENETECH/PACIFICORP WINDPOWER PROJECT CARBON COUNTY, WYOMING

(X) Draft ( ) Final

U.S. Department of the Interior
Bureau of Land Management

Abstract:

This Draft Environmental Impact Statement assesses the environmental consequences of a proposed windpower development project in Carbon County, between Arlington and Hanna, Wyoming. Public scoping commenced in January 1994. All issues raised during scoping and interdisciplinary team preparation of the analysis are addressed. The proposed project entails the erection of approximately 1,390 wind turbine generators and associated facilities (e.g., roads, substations, distribution and communications lines) by KENETECH Windpower, Inc. A 230-kV transmission line would be built by PacifiCorp, Inc. to connect a proposed substation on Foote Creek Rim near Arlington to the Miner's substation near Hanna. The proposed project would use standard procedures as currently employed by other right-of-way projects, plus additional project-specific and site-specific mitigation measures to ensure that project impacts are minimized on all important resources. Impacts to most resources would be negligible to moderate during the life-of-project. Potentially significant impacts resulting from the project include avian mortality; declining avian populations; threatened, endangered, candidate, and/or state sensitive species mortality and/or habitat loss; disturbance to nearby residents due to noise; changes in visual resources; disturbance of important Native American traditional sites; changes in plant community species composition due to snow redistribution; displacement of big game due to windfarm operation; and loss of sage grouse nesting habitat. The proposed project could also have numerous beneficial impacts including increased revenues generated by taxes, increased employment, and benefits derived from using a nonpolluting resource for electric power generation.

EIS Contact:

Comments on this EIS should be directed to:

Area Manager
Great Divide Resource Area
Bureau of Land Management
P.O. Box 670
Rawlins, Wyoming 82301

For further information contact Walt George at the Rawlins District Office, (307) 324-7171.

Date Draft EIS made available to EPA and Public: January 20, 1995.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

In Reply Refer To:

1793
(934JJohnson)
PHONE NO: 307-775-6116
FAX NO: 307-775-6082

Dear Reader:

This draft Environmental Impact Statement (EIS) is prepared pursuant to 40 CFR 1500-1508, for the Kenetech Wind Energy Project in Carbon County, Wyoming. The EIS is provided for your review and comment and the final Environmental Impact Statement (EIS) will be based on comments received on this draft. Please keep this copy of the draft EIS for future use in your review of the final EIS.

The public comment period for this EIS will close 60 days after the Environmental Protection Agency publishes their Notice of Availability of the EIS in the Federal Register. The notice is expected to be published January 27, 1995. When making written comments, please be as specific as possible and identify the chapter, page, and paragraph to which the comments pertain. The purpose of the review and comment period is to provide you an opportunity to participate in the environmental analysis process and the ultimate decisions reached.

Public meetings are scheduled for the Kenetech Wind Energy Project EIS at the Jeffrey Center, Third and Spruce Streets, Rawlins, Wyoming, on February 8, 1995, at 7 p.m. and on February 9, 1995, at the Albany County Public Library, Large Meeting Room, 310 S. 8th Street, Laramie, Wyoming, at 7 p.m.

Please address or call comments on this draft EIS or requests for additional copies of the EIS to:

Bureau of Land Management
Rawlins District Office
P.O. Box 670
Rawlins, WY 82301
Attn: Walter E. George, Project Leader
(307) 324-7171 - voice
(307) 324-5423 - fax

Sincerely,

Gordon Schaffer
State Director
ACTING

EXECUTIVE SUMMARY

This Draft Environmental Impact Statement (DEIS) was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, to consider potential environmental consequences (both positive and negative) of a proposed 500-megawatt (MW) Windplant™ in the Foote Creek Rim - Simpson Ridge area between the towns of Hanna and Arlington in southeastern Wyoming. The proposed KENETECH Windpower, Inc. (KENETECH)/PacifiCorp, Inc. (PacifiCorp) project area (KPPA) is defined as the Foote Creek Rim and Simpson Ridge project areas plus three alternate transmission line routes. Under the Proposed Action, the Bureau of Land Management (BLM) would issue a 30-year renewable right-of-way (ROW) grant to KENETECH for construction of the full 500-MW Windplant and a ROW grant to PacifiCorp to construct a 230-kilovolt (kV) transmission line along one of the three alternate routes. The BLM is the lead agency for Environmental Impact Statement (EIS) preparation; the Bonneville Power Administration (BPA), which would buy a portion of the electric power, is a cooperating agency. Two alternatives (Alternative A and a No Action Alternative) were analyzed. Alternative A would involve construction of a 300-MW Windplant plus the 230-kV transmission line. Under the No Action Alternative, BLM would deny the ROW grant and BPA would not execute a power purchase agreement with PacifiCorp. The No Action Alternative is not expected to result in direct development of another energy source within the KENETECH/PacificCorp Project Area, the Great Divide Resource Area, or the area serviced by Bonneville Power Administration, PacifiCorp, Tri-State Generation and Transmission Company, Public Service Company of Colorado, or Eugene Water and Electric Board. A scoping statement was mailed to potentially interested parties and the media in January 1994. Issues and concerns identified by the public, BLM, and other governmental organizations regarding the proposed action and analyzed in this EIS are as follows:

Key issues

- wind turbine effects on birds,
- direct and indirect wildlife habitat loss,
- big game winter range and migrations,
- threatened, endangered, candidate, and state sensitive (TEC&S) and priority plants and animals and their habitats,
- cultural resources and Native American spiritual values, and
- reasonable access to public land.

Other issues and concerns raised during public scoping

- visual resources and aesthetics,
- benefits/disadvantages of wind energy vs. other energy sources,
- noxious weed control,
- highly erodible and unstable soils,
- wetlands and riparian areas,
- paleontological resources,
- reclamation potential,
- surface and groundwater,
- conformance with current and future land uses,
- compatibility with management plans and objectives,
- noise impacts on residents and wildlife,
- impacts to recreation (e.g., hunting and access),
- social and economic effects on local communities,
- revenue generation and job availability,
- areawide transmission capabilities,
- impacts to existing pipelines,
- impacts to other potential wind developers,
- compatibility with other energy industries,
- increased traffic on roads and increased human activity, and
- public safety, law enforcement, and travel management.

All written and verbal comments received on the proposed project were considered in the preparation of this DEIS. The proposed project, as planned, is in conformance with the BLM Great Divide Resource Area Resource Management Plan,

BPA's Resource Supply Expansion Program, the State of Wyoming Land Use Plan, and the Carbon County Land Use Plan.

The purposes of the Proposed Action, or project, are to provide wind-generated electricity from a site in Wyoming to meet existing electricity needs; test the ability of wind energy to provide a reliable, economical, and environmentally acceptable energy resource in the region; and develop a further market for Wyoming-sourced wind-generated electricity. Utilities providing electrical power to Rocky Mountain and southwestern states have forecast that greater than 9,000 MW of new generating capacity will be needed during the next 20 years to meet base load and peak load electricity demands.

The project, as proposed by KENETECH, is to construct and operate wind turbines and associated facilities in phases on approximately 60,619 acres (ac) of federal (28%), state (10%), and private (62%) lands within R78W-R82W, T19N-T22N, in Carbon County of southcentral Wyoming. Southern Wyoming has some of the most consistent high wind speeds in the conterminous United States [U.S. wind speeds average 10-17 miles per hour (mph) (4.5-7.8 meters per second [m/s])]. The KPPA is located within a unique gap in the Rocky Mountains which accelerates winds to an annual average of 21.5 mph (9.6 m/s). The Windplant (including turbines and operations, maintenance, communications, and transmission facilities) would be developed in phases, beginning with approximately 201 wind turbines to generate 70.5 MW along the Foote Creek Rim area and a 230-kV transmission line from Foote Creek Rim to the existing Miner's substation near Hanna. PacifiCorp would own the first phase of the Windplant and would construct the 230-kV transmission line. KENETECH proposes to use Model 33M-VS wind turbine generators supported by 80-120 ft (24-37 m) tall modified tubular towers spaced approximately 162-216 ft (49-66 m) apart within rows and approximately 1,080-1,620 ft (329-494 m) between rows. Additional turbines and facilities would be erected in 50 to 100-MW phases over the next 10-12 years as utilities in the western United States seek additional capacity to satisfy base load and peak electrical power demands. The complete Windplant would consist of approximately 1,390 turbines, with up to 575 turbines (generating 200 MW) at the Foote Creek Rim area and 815 turbines (generating 300 MW) in the Simpson Ridge area.

Considered in this EIS are the Proposed Action, an alternative representing a 40% reduction in the Proposed Action, and a No Action Alternative. Three alternate transmission line routes are also analyzed in this DEIS, as part of the Proposed Action and Alternative A. Four other alternatives to the proposed action (i.e., selecting an alternate project location, expanding or reducing the project area size, constructing the project in one phase, and generating the 500 MW of power via other energy sources) were considered but rejected because they did not meet the purpose and need or were not reasonably feasible.

The proposed project would initially disturb 319 ac for Phase I and 1,787 ac for the 500-MW Windplant, including the Windplant (136-1,595 ac), substations (4-13 ac), and the 230-kV transmission line route (156-179 ac, depending on which of three alternate routes selected). Under Alternative A, 1,146 ac of initial disturbance would occur, including the Windplant (957 ac), substations (10 ac), and the 230-kV transmission line (156-179 ac). Approximately 439 ac of existing disturbance from roads (166 ac), pipeline (241 ac), telephone cables (22 ac) and oil and gas wells (10 ac) is already present in the area. Nearly 70% of initially disturbed lands will be in the predominantly sagebrush shrubland and mixed grass sagebrush shrubland vegetation types. Planned mitigation measures would reduce the life-of-project (LOP) disturbance area to 68 ac for Phase I and 715 ac for the 500-MW Windplant, or 431 ac for Alternative A.

It is anticipated that 126 people per day would be required during construction of the first phase of development, with most construction work to be

completed between April and September in a given year. Additional phases would employ 86 to 172 people, depending on the size of the phase being constructed. Operation and maintenance (O&M) of the Windplant would require up to nine Windsmiths (specially trained O&M personnel) for the first phase of development and an additional 20 Windsmiths to operate and maintain the full 500-MW Windplant. During construction, the average number of daily vehicle trips to the site would range from 30-70, while the average number of vehicles actually working on-site would be 15-40. During normal O&M, daily traffic to and on the site would include five 4-wheel drive pickups for the first phase of development and 10 pickups for the full 500-MW Windplant.

The KPPA is located in an area characterized by steep and flat-topped ridges bounded on the south by the Medicine Bow Mountains; on the north by the Seminoe, Shirley, and Freezeout Mountains; and on the west and east by the Carbon and Laramie Basins, respectively. Climate in the area is classified as continental, semiarid, cold desert with an average annual precipitation of 10-14 inches (25-35 cm). Air quality is generally good with suspended particulates comprising the principal air quality pollutant. The area is cut by several perennial and numerous ephemeral streams. Groundwater and surface water are variable in quality. Major land uses within and adjacent to the KPPA are agriculture (primarily cattle and sheep grazing); wildlife habitat; oil and gas exploration, development, and transportation; and dispersed outdoor recreation. No developed recreation resources exist within the KPPA; however, the Wick Brothers Wildlife Habitat Unit, which includes approximately 77% of the Foote Creek Rim area, was set aside by the Wyoming Game and Fish Department (WGFD) for recreational purposes.

No coal or uranium development and only limited oil and gas development are presently occurring within the KPPA and the potential for extant development of these resources in the foreseeable future is low. Salable minerals are being excavated from local sources within the project area. There is one known fossil locality in the area, and local rock formations are known to contain important and abundant fossils, both locally and in other parts of Wyoming.

A wide variety of soils occurs within the KPPA due to varying parent materials, topographic position, local hydrology, vegetation, and other factors. On top of Foote Creek Rim, soils are predominantly gravels and are well suited to the type of development proposed. In other parts of the KPPA, particularly in the Simpson Ridge area, soils exhibit sensitivity to disturbance from development activities, having moderate to high water erosion and severe wind erosion potentials. Vegetation is predominantly a mixed grassland/sagebrush shrubland comprised of big sagebrush and other shrubby species and a variety of shortgrass and forb species. The density of the vegetation varies greatly from one location to another, controlled by extremes in soils, available nutrients, pH, and soil moisture. Livestock annual range productivity varies from near 0 lbs/ac (on extreme sites) to 3,500 lbs/ac on meadow/riparian areas in excellent condition during years with normal precipitation. The latter type occupies <1% of the KPPA. Potential wetlands are sparsely scattered throughout the project area, and are commonly associated with ephemeral drainages, impoundments, and major stream channels.

Four big game mammal species commonly occur within or adjacent to the project area: pronghorn antelope, mule deer, elk, and white-tailed deer. Nearly all of the wildlife habitat on the Foote Creek Rim area and two-thirds of the habitat on the Simpson Ridge area is considered winter/yearlong range for all but white-tailed deer. Seven percent of the wildlife habitat in the Simpson Ridge area is considered crucial winter/yearlong range for pronghorn. The entire KPPA is considered suitable habitat for raptor hunting, foraging, and perching, and these, along with other nonraptor bird species, are considered vulnerable to collisions with wind towers. Also of concern are 44 sage grouse breeding areas known to exist within the KPPA. A number of

threatened, endangered, candidate, and sensitive plant and animal species are known to occur or could occur in the KPPA. Of primary concern among those known to occur are the bald eagle, peregrine falcon, mountain plover, and ferruginous hawk. The mountain plover, a candidate for threatened and endangered (T&E) listing, has been frequently observed in the Foote Creek Rim area. Approximately 35% of the Simpson Ridge area is classified as a primary management zone (PMZ) for the re-introduction of black-footed ferrets (BFFs).

The negative impacts on air quality, topography, mineral/gas and oil development, geologic hazards, paleontological resources, surface water and groundwater resources, odor, vegetation (with the possible exception of changes in plant community composition due to snow redistribution and potential unsuccessful reclamation), wetlands, socioeconomics, land use, and hazardous materials are expected to be negligible. Impacts could be negligible to beneficial for air quality (by replacing a proportion of the electrical generation and associated pollutants, which would otherwise come from the burning of fossil fuels), for socioeconomics (through increased federal, state, and local revenues), and for land use (potential increased tourism). Moderate negative impacts are expected in terms of increased soil erosion potentials, increased noise levels within important wildlife habitats during critical periods, and for land use (possible changes in recreational use of the KPPA) due to the construction and presence of facilities. Potentially significant impacts resulting from the proposed project include:

- direct losses of big game crucial habitat;
- indirect displacement and/or stress of big game by construction and/or operation of proposed facilities by humans;
- raptor mortality due to collisions with wind towers or power lines;
- declining raptor populations;
- loss of sage grouse nesting habitat;
- mortality or displacement of any listed or candidate T&E species or disturbance of their critical habitat;
- possible unsuccessful long-term (5-year) revegetation on some sites;
- disturbance of important Native American traditional sites;
- increased noise levels near residences; and
- modification of the basic elements (form, line, color, or texture) of visual resources by presence of Windplant facilities.

A number of other potential impacts to wildlife (e.g., declines in common nonraptor species), cultural resources (e.g., disturbance/destruction of important sites, loss of important cultural materials due to private collection or vandalism), and socioeconomics (e.g., increase in population, increase in demand for local services) were considered, but were estimated to be negligible.

A number of project-wide mitigation measures are proposed to avoid, reduce, or eliminate project impacts. Because wildlife impacts of wind energy generation are not completely understood for this area at this time, an extensive monitoring program has been proposed as an integral part of the mitigation package. Data from early phases of this study program will be utilized by the BLM, KENETECH, and a technical advisory committee involving other cooperating agencies to adjust facility operations and to further reduce project impacts in later phases of development, if necessary. The 22 project-wide mitigation measures to be implemented from the outset may be summarized as follows:

1) Mitigation measures would be adhered to on federal and state lands, and on private lands, subject to landowner preferences.

2) Windplant facilities (e.g., turbine towers, roads, power lines) would be placed to minimize or avoid disturbance in areas with high value wildlife habitat (e.g., crucial winter range, wetlands, and riparian areas).

3) Areas with high erosion potential and/or rugged topography (i.e., steep slopes, dunes, floodplains, unstable soils) would

be avoided, where feasible. If disturbance in these areas is necessary, stringent erosion control and soil stabilization measures would be implemented immediately.

4) Surface disturbance or occupancy would not occur on slopes in excess of 25%, where feasible, nor would construction occur when soils are wet or frozen, whenever feasible.

5) Removal or disturbance of vegetation would be kept to a minimum through construction site management (e.g., utilizing previously disturbed areas, using existing ROWs, designating limited equipment/materials storage yards and staging areas, scalping, etc.).

6) Topsoil would be salvaged prior to construction to facilitate revegetation. After construction, all salvaged topsoil would be spread evenly over all surfaces to be revegetated and seeded. All seeding would use an approved mixture of native and/or introduced species. Because of the extended LOP, no topsoil would be stockpiled beyond completion of post-construction reclamation.

7) Revegetation methods would include:
   a) deep ripping of compacted soil prior to reseeding, where necessary;
   b) broadcast or drill seeding, depending on site conditions;
   c) fall seeding (September 15 to freeze-up), where feasible;
   d) spring reseeding (after the ground thaws and prior to April 15) if fall seeding is not feasible;
   e) utilization of native cool season grasses, forbs, and shrubs in a mixture specified by KENETECH and PacifiCorp and approved by the landowner or BLM;
   f) addition of BLM-approved introduced species (e.g., crested wheatgrass, Russian wildrye) to the seed mixture if attempts at revegetation with native species are unsuccessful;
   g) installation of waterbars on disturbed slopes with grades of 6% or greater to reduce erosion (waterbars may be installed on disturbed slopes with grades less than 6% in areas with unstable soils); and
   h) possible fencing of sensitive reclamation sites.

8) Vegetation and soil removal would be accomplished in a manner that would prevent erosion and sedimentation.

9) Construction would be avoided within 500.0 ft (152.4 m) of surface water or wetland areas where feasible. Where wetlands, riparian areas, or ephemeral stream channels must be disturbed, the following measures would be employed:
   a) Wetland areas would be crossed during dry conditions (i.e., late summer, fall, or dry winters).
   b) Streambeds would be crossed perpendicular to flow, where feasible.
   c) Streams, wetlands, and riparian areas disturbed during project construction would be restored to pre-project conditions. If impermeable soils contributed to wetland formation, soils would be compacted to restore impermeability.
   d) Recontouring and appropriate/adapted species would be used to revegetate the banks to aid in soil stabilization.
   e) Revegetation operations would begin on impacted areas immediately after completion of project construction activities.

10) Intermittent and ephemeral drainages would be protected from surface disturbance within 75.0 ft (22.9 m) of the channel or the inner gorge, whichever is closer, where feasible.

11) Temporary erosion control measures such as mulch, jute netting, sediment traps, or other appropriate methods would be used on unstable soils, steep slopes, and wetland areas to prevent erosion and sedimentation until vegetation becomes established.

12) 230-kV transmission line structures would be located at least 40.0 ft (12.2 m) from pipelines, and conductors would be at least 30.0 ft (9.1 m) above ground level at all pipeline and road crossings. Structures would be located at least 100.0 ft (30.5 m) from all streams. Stream crossings would be avoided during materials-hauling and structure-assembly and erection by using existing roads to access the ROW, where feasible. Where conductors must be strung across perennial streams, ropes would be used to haul the conductors across the stream. Intermittent or ephemeral channels would be crossed during periods of no flow.

13) Surface disturbance within 0.75 mi (1.2 km) of active raptor nest sites (i.e., used within the last three years) would be avoided during the nesting season (February 1 through July 31). If the area must be impacted, project activities would occur outside the nesting season. Extensive raptor nesting studies are being completed as part of the baseline avifauna studies and would continue as part of the monitoring program for the project.

14) Windplant facilities would be designed or equipped to prevent raptor perching (e.g., using tubular rather than lattice towers, equipping turbine nacelles and power poles within the Windplant with raptor antiperching devices).

15) Poles for collection and transmission lines located within 0.25 mi (0.4 km) of sage grouse leks would be equipped with raptor antiperching devices to minimize the opportunities for raptors to prey on sage grouse. Poles located near prairie dog colonies within the BFF PMZ also would be equipped with raptor antiperching devices to minimize the take of prairie dogs or the potential take of BFFs by birds of prey.

16) To protect important big game winter habitat, activities or surface use would not be allowed from November 15 to April 30 within certain areas encompassed by the ROW grant. The same criterion would apply to defined big game birthing areas from May 1 to June 30.

17) Known active sage grouse leks and adjacent public land areas [2.0 mi (3.2 km) radius from lek centers] would be avoided during the breeding and nesting seasons from March 1 through June 30. No construction activities would be conducted on public lands within 0.25 mi (0.4 km) of known nest sites; and project activities, other than those required for O&M along existing roads within 0.25 mi (0.4 km) would be curtailed during the period from 1 hr before daylight to 9:00 a.m. from March 1 through April 30.

18) Substations and other areas that would be hazardous to wildlife would be fenced as directed by the BLM.

19) Paleontological and archaeological surveys would be completed prior to disturbance, with monitoring as necessary during disturbance of impacted areas with high resource potential. Paleontological or cultural

resource sites would be avoided or mitigated, as necessary, prior to disturbance. Any cultural or paleontological resource discovered by the operator or any person working on his or her behalf would be immediately reported to the BLM. All construction operations within 50.0 ft (15.2 m) of such a discovery would be suspended as required by BLM regulations until written authorization to proceed is issued by the Authorized Officer (AO). An evaluation of the discovery would be made by the AO to determine appropriate actions to prevent the loss of significant cultural or scientific values.

20) Approval from the BLM AO in consultation with other agency personnel [e.g., WGFD, U.S. Fish and Wildlife Service (USFWS)] would be required prior to construction in areas (e.g., crucial water ranges, near raptor nests) where federal regulations are applied to protect sensitive resources (e.g., wildlife). This action would allow project activities to proceed in restricted areas and/or during periods of restriction (e.g., mild winters, abandoned raptor nest sites, etc.), if deemed appropriate.

21) KENETECH would continue to work with BLM and Native American tribes on mitigative measures for cultural resources through each phase of the project.

22) All livestock control fences would conform to BLM Manual Handbook H-1741-1 for the passage of wildlife.

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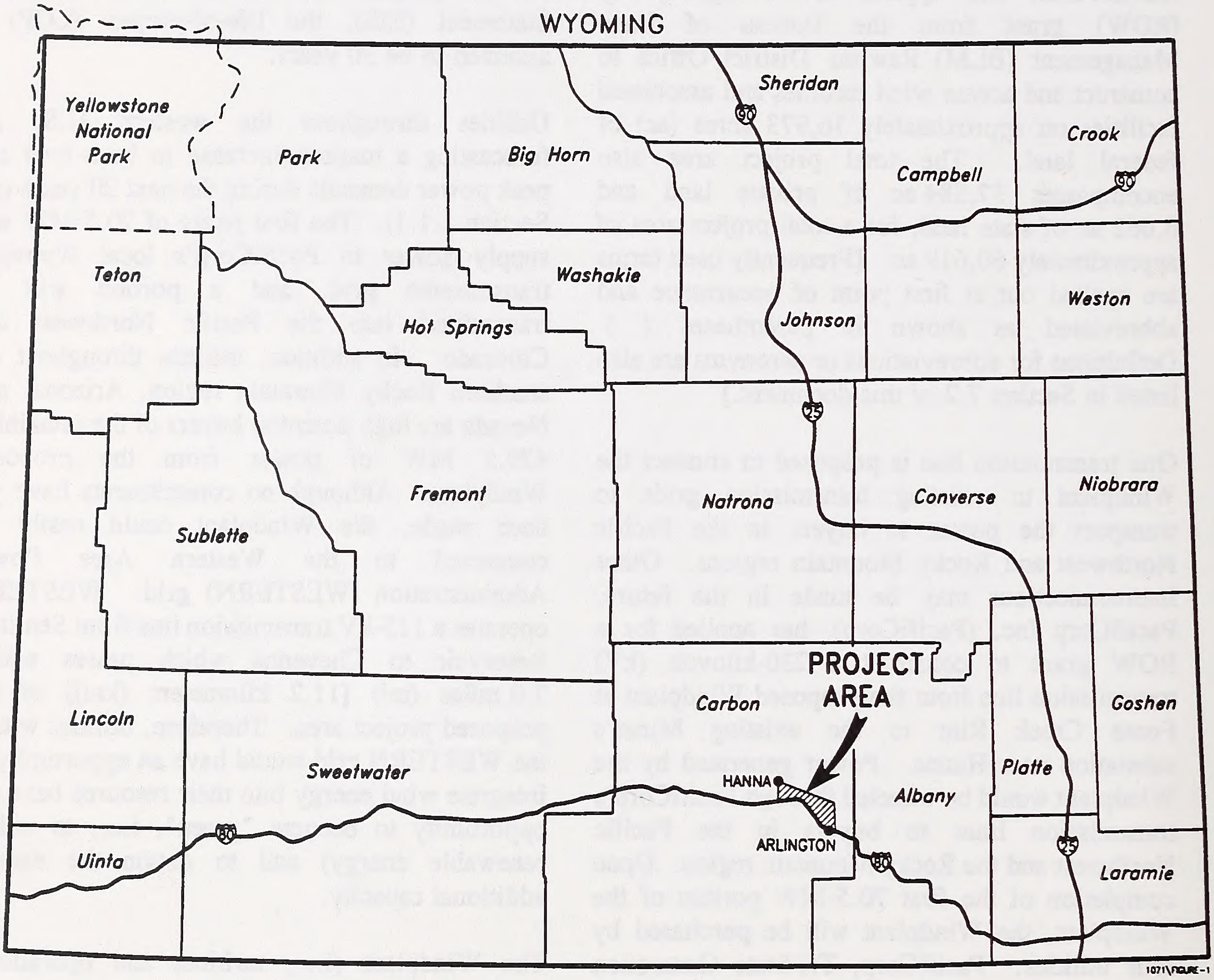
1.0 INTRODUCTION

KENETECH Windpower, Inc. (KENETECH) is proposing to develop a 500-megawatt (MW) windpower plant (Windplant™) in the Foote Creek Rim-Simpson Ridge area between Hanna and Arlington, Carbon County, Wyoming (Map 1.1). KENETECH has applied for a right-of-way (ROW) grant from the Bureau of Land Management (BLM) Rawlins District Office to construct and access wind turbines and associated facilities on approximately 16,973 acres (ac) of federal land. The total project area also encompasses 37,584 ac of private land and 6,062 ac of state land, for a total project area of approximately 60,619 ac. [Frequently used terms are spelled out at first point of occurrence and abbreviated as shown in parentheses ( ). Definitions for abbreviations or acronyms are also listed in Section 7.2 of this document.]

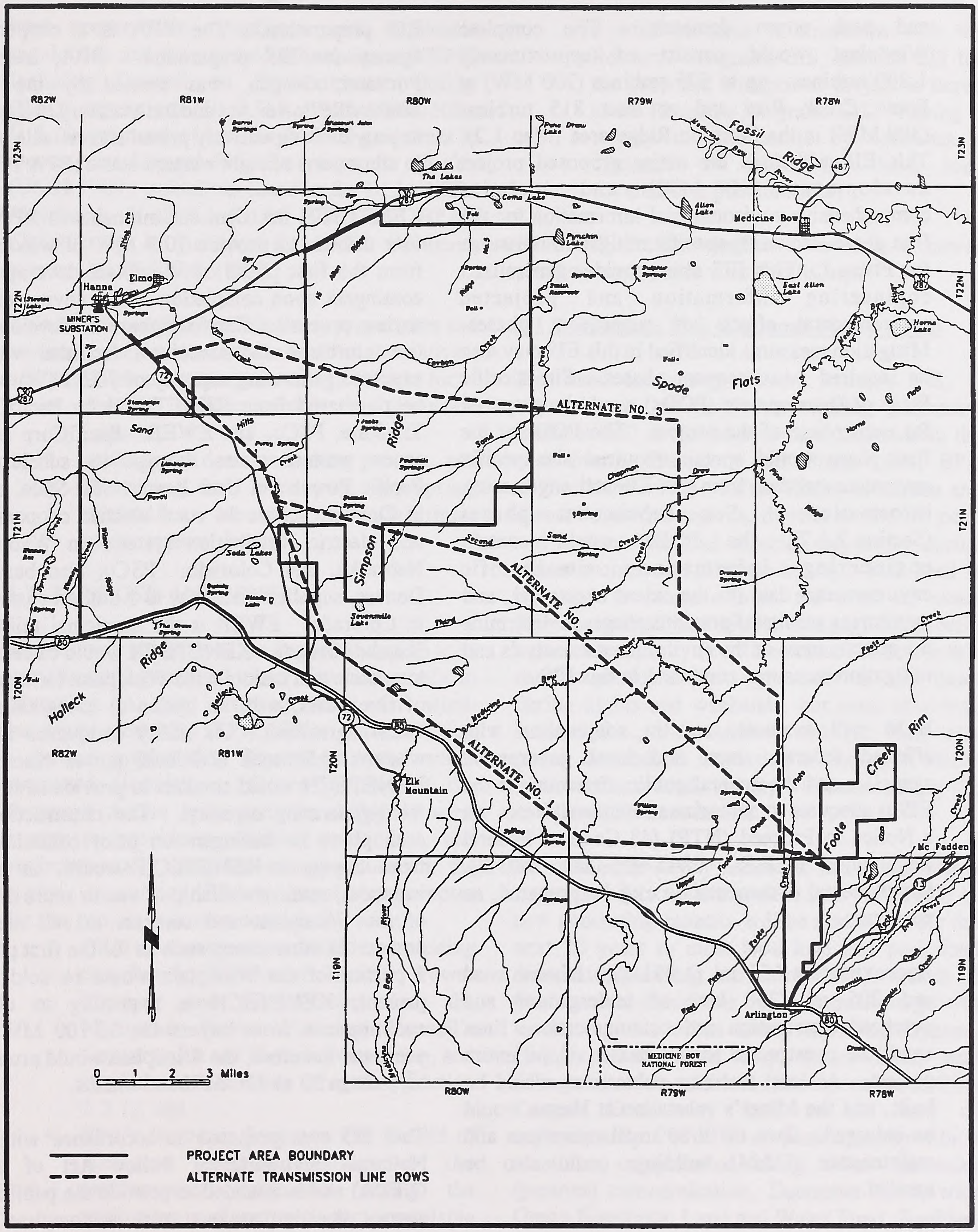
One transmission line is proposed to connect the Windplant to existing transmission grids to transport the power to buyers in the Pacific Northwest and Rocky Mountain regions. Other interconnections may be made in the future. PacifiCorp Inc. (PacifiCorp), has applied for a ROW grant to construct a 230-kilovolt (kV) transmission line from the proposed Windplant at Foote Creek Rim to the existing Miner's substation near Hanna. Power generated by the Windplant would be wheeled through PacifiCorp's transmission lines to buyers in the Pacific Northwest and the Rocky Mountain region. Upon completion of the first 70.5-MW portion of the Windplant, the Windplant will be purchased by four utilities: PacifiCorp, Tri-State Generation and Transmission Company (Tri-State), Public Service Company of Colorado (PSCo), and the Eugene Water and Electric Board (EWEB). The Bonneville Power Administration (BPA) has signed a letter of agreement with PacificCorp to purchase up to 25 MW of power from the proposed Windplant upon satisfactory completion of the environmental review process and approval of the first phase. The federal actions associated with the proposed development consist of the BLM issuing a ROW grant for access to public lands for the construction, operation, and maintenance of the full 500-MW Windplant plus PacifiCorp's 230-kV transmission line and BPA execution of a Power Purchase Agreement. The ROW grant would have a 30-year term and could be renewed indefinitely. For the purposes of the Environmental Impact Statement (EIS), the life-of-project (LOP) is assumed to be 30 years.

Utilities throughout the western U.S. are forecasting a marked increase in base load and peak power demands during the next 20 years (see Section 1.1.1). The first phase of 70.5-MW will supply power to PacifiCorp's local Wyoming transmission grid, and a portion will be transmitted into the Pacific Northwest and Colorado. In addition, utilities throughout the southern Rocky Mountain region, Arizona, and Nevada are high potential buyers of the remaining 429.5 MW of power from the proposed Windplant. Although no commitments have yet been made, the Windplant could easily be connected to the Western Area Power Administration (WESTERN) grid. WESTERN operates a 115-kV transmission line from Seminoe Reservoir to Cheyenne which passes within 7.0 miles (mi) [11.2 kilometers (km)] of the proposed project area. Therefore, utilities within the WESTERN grid would have an opportunity to integrate wind energy into their resource base (an opportunity to become "green", i.e., to utilize renewable energy) and to obtain the needed additional capacity.

The Windplant (i.e., turbines and operations, maintenance, communications, and transmission facilities) would be developed in phases, beginning with erection of approximately 201 wind turbines and associated facilities along Foote Creek Rim (Map 1.2) and a 230-kV transmission line from Foote Creek Rim to the Miner's substation. The first phase would have a generating capacity of 70.5 MW. Additional turbines and facilities would be erected in 50 to 100-MW phases over the next 10 to 12 years as utilities in the western U.S. seek additional capacity to satisfy base load



Map 1.1 Project Location.



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Map 1.2 Foote Creek Rim and Simpson Ridge Project Areas and Three Alternate Transmission Line Routes.

and peak power demands. The complete Windplant would consist of approximately 1,390 turbines: up to 575 turbines (200 MW) at Foote Creek Rim and at least 815 turbines (300 MW) in the Simpson Ridge area (Map 1.2). This EIS addresses the entire proposed project development (500 MW) and includes comprehensive environmental information for the first phase, including specific mitigation measures for Phase I. This EIS also provides generalized engineering information and projected environmental effects of subsequent phases. Mitigation measures identified in this EIS may also be required in subsequent phases. Site-specific Plans of Development (PODs) would be prepared for each phase of the project. The POD for the first phase would contain required site-specific environmental data from this EIS and engineering information. For subsequent phases (Section 2.1.2), the PODs would contain engineering information, site-specific environmental data (to the extent necessary), and monitoring results of previous phases to determine the effectiveness of the environmental analysis and mitigation measures contained in this EIS.

BLM will evaluate, and in conjunction with affected federal, state, and local government agencies, and the general public, determine if the EIS is adequate to authorize subsequent phases via a Notice to Proceed (NTP) [43 Code of Federal Regulations (C.F.R.) 2802.4(h) and 2803.2]. Supplemental documentation may be prepared, as necessary.

Approximately 653 mi (1,051 km) of new road and 205 mi (330 km) of underground and overhead distribution and communications lines would be constructed for all phases of the entire project. At least two new substations would be built, and the Miner's substation at Hanna would be enlarged. Two or three small operations and maintenance (O&M) buildings could also be erected.

The project area is entirely within the Great Divide Resource Area (GDRA) of the Rawlins BLM District, and the BLM is the lead agency for EIS preparation. The BPA is a cooperating agency for EIS preparation. BPA, based in Portland, Oregon, was created by the 1937 Bonneville Power Act and has statutory obligations to provide competitively priced and reliable power to all or parts of eight western states (BPA 1993a).

KENETECH has firm commitments to BPA and four utilities to provide 70.5 MW of windpower from the first phase of Windplant development, contingent upon completion of the environmental review process. The first phase of development (i.e., turbines and associated facilities with an expected generating capacity of 70.5 MW) would be purchased from KENETECH by PacifiCorp, Tri-State, PSCo, and EWEB. PacifiCorp serves seven western states through its subsidiaries, Pacific Power and Utah Power. Tri-State, based in Denver, serves 34 rural electric cooperatives and electric distribution systems in Wyoming, Nebraska, and Colorado. PSCo, also based in Denver, supplies electricity to 1 million customers in Colorado. EWEB is the municipal utility of Eugene, Oregon. KENETECH would be retained to operate and maintain the Windplant for a period of five years, with an option to renegotiate the O&M agreement. As utility companies in the western U.S. seek additional power resources, KENETECH would contract to provide additional wind-generating capacity. The construction of each phase is contingent on prior commitments from buyers. KENETECH would, in some instances, retain ownership of one or more phases of the Windplant and contract to sell electric power. In other cases, such as for the first phase, a portion of the Windplant would be sold. At present, KENETECH is expecting to obtain commitments from buyers for 50-100 MW per year, and therefore, the Windplant would probably be built in 50 to 100-MW increments.

This EIS was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and is intended to provide the public and agency decision makers with a complete and objective evaluation of impacts, both beneficial and adverse, resulting from the Proposed Action and its reasonable alternatives. This document has

been prepared in compliance with applicable regulations and laws passed subsequent to NEPA, including Council on Environmental Quality (CEQ) regulations (40 C.F.R., Part 1500-1508); U.S. Department of Interior (USDI) guidelines in *Department Manual 516, Environmental Quality* (USDI 1980); guidelines listed in the BLM *NEPA Handbook, H-1790-1* (BLM 1988); and BPA's *Checklist of 16* guidance for NEPA document preparation (Schmidt 1991).

This EIS, through interdisciplinary preparation and review, consideration of reasonable alternatives, and public participation, serves as a vehicle for:

- defining project-related environmental impacts,
- assisting the decision-making process, and
- identifying and developing appropriate mitigation measures to minimize environmental impacts.

1.1 PURPOSE AND NEED

The primary purpose of the Proposed Action is to provide wind-generated electricity from a site in Wyoming to meet existing needs for wind-generated electricity (BPA 1993a) and to develop a further market for Wyoming-sourced wind-generated electricity. BPA's purpose of the Proposed Action is to test the ability of wind energy to provide a reliable, economical, and environmentally acceptable energy resource in the region. In addition, BPA has regulatory purposes for the project to assure consistency with:

- BPA's statutory responsibilities, including the Pacific Northwest Electric Power Planning and Conservation Act, the Northwest Power Planning Council's Conservation and Electric Power Plan, and its Fish and Wildlife Program (Section 1.2.1); and
- BPA's Resource Programs EIS Record of Decision (ROD) considered the environmental trade-offs among the various types of energy resources available and the environmental impacts of adding these resources to its existing power system (BPA 1993a). The acquisition of a wind resource is consistent with the Resource Programs EIS, and the EIS for the proposed windpower project is tiered to the Resource Programs EIS. (Tiering is a way to incorporate by reference a discussion of issues that have been covered in a previous EIS).

BPA will decide whether to execute a power purchase agreement with PacifiCorp.

1.1.1 Western U.S. Regional Power Needs

The need for energy in the western U.S. is increasing to the level that existing generating facilities will not be able to meet demands in the near future (Eisenberg and Blank 1994; BPA 1993a; Kahn 1993). In the Rocky Mountain and desert Southwest regions, there is a need for peak and intermediate load capacity (especially during winter months and daytime hours). This need is expected to increase over the next 20 years (Eisenberg and Blank 1994). The region currently has excess capacity (i.e., the amount of power that can be produced by a generator at any time) during nights and weekends, but even base load demand (i.e., the relatively constant, long-term power demand) is increasing to the point where additional base load capacity will be needed by the middle of the next decade.

Six utilities in Rocky Mountain and southwestern states have forecast that greater than 9,000 MW of new generating capacity will be needed during the next 20 years to meet base load and peak load demands (Eisenberg and Blank 1994). Much of the increased demand is due to population growth in the region's urban areas, including Denver, Phoenix, Salt Lake City, Las Vegas, and Albuquerque. In addition, the reoperation of Glen Canyon Dam may lead to the loss of approximately 700 MW of peak capacity which must be compensated using other resources (personal communication, December 1994, with Gregg Eisenberg, Land and Water Fund, Boulder, Colorado). Reoperation involves changes in the water release schedule to improve the water

regime for endangered fish species downstream in the Colorado River.

In the Pacific Northwest, recent legislation on hydropower systems and the retirement of several nuclear power plants have caused a decline in generating capacity throughout the western U.S. The Pacific Northwest has been especially dependent on hydropower, but many of the hydropower projects in the region are reducing capacity to meet new standards to protect salmon in the Columbia River system (Kahn 1993). In the Pacific Northwest alone, the expected generating loss due to cutbacks in hydropower would be approximately 3,000 MW (Kahn 1993). The closure of the Trojan Nuclear Power Plant in January 1993, contributed to further losses of generating capacity. Although BPA presently has a surplus of generating capacity, these losses plus the expected growth in the region would eventually create a need for new generating sources.

1.1.2 The Wyoming Wind Resource

The wind resource in southern Wyoming has been studied since the 1970s (Martner 1981; Marwitz and Martner 1981; Martner and Marwitz 1982; Marwitz and Dawson 1984), and the data show that southern Wyoming has the most consistent high wind speeds in the conterminous U.S. (approximately 15 times the wind resource of California). The proposed project area is located within a unique wind corridor created by a 62 mi (100 km) gap in the Rocky Mountains where a venturi effect (i.e., squeezing wind through the gap) accelerates wind speeds. Ridges (e.g., Foote Creek Rim) perpendicular to wind flow in this corridor cause further wind acceleration. Even short distances away from this natural venturi, wind speeds drop substantially (Table 1.1). Annual wind speeds on Foote Creek Rim average 21.5 miles/hour (mph) [9.6 meters/second (m/s)], while at other locations in southern Wyoming, wind speeds range from 9.6 to 17.4 mph (4.3-7.8 m/s; 19-55% lower than at Foote Creek Rim). Because the actual energy produced by a wind turbine is approximately the square of wind speed, a site with 25% higher wind speeds would produce approximately 50% more power with the same number of turbines.

The cost per kilowatt hour (kWh) of wind-generated electricity is a function of the quality of the wind resource at the generation site. Sites having consistent wind speeds greater than 15 mph (6.7 m/s) (e.g., Foote Creek Rim) enable more cost-effective power generation, and thus, lower kWh costs for the utility, and ultimately, for the consumer. Most of the western states' public utility commissions require utilities to prepare an Integrated Resource Plan (IRP) to compare the cost of electric power generated by various resources (i.e., coal, gas, renewables, and conservation). Under IRP regulations, cost is one of the primary considerations in selecting future generating resources. Therefore, wind energy must be reasonably cost-competitive to be considered in an IRP. Table 1.2 presents a comparison of power costs per kWh for various resources, including the proposed Windplant at Foote Creek Rim, and shows that wind-generated electric power can be cost-competitive with fossil fuel and hydropower resources.

The proposed project area not only has a high quality wind resource, but the highest wind speeds coincide with periods of peak demand for utilities in the western U.S. (i.e., winter months and daytime hours). Based on PSCo's 1993 IRP (PSCo 1993), total on-peak production from the Foote Creek Rim site has an average capacity factor of 72.8% (i.e., during on-peak hours the Windplant is generating power at 72.8% of its full capacity). For comparison, the capacity factor for a typical hydroelectric plant is 40%, and coal-fired generators typically have 70-90% capacity factors.

1.2 RELATIONSHIP TO BLM, BPA, AND OTHER POLICIES, PLANS, AND PROGRAMS

1.2.1 BLM and BPA Policies, Plans, and Programs

The development of energy resources is an integral part of the BLM management program under the

Table 1.1 Average Winter Wind Speeds in Southern and Central Wyoming.[1]

Location	Wind Speed mph	Wind Speed m/s	Percent of Wind Speeds on Foote Creek Rim
Arlington (Foote Creek Rim)	21.5	9.6	100
Medicine Bow, Bureau of Rec. Turbines	17.4	7.8	81
Fish Hatchery (3 mi NW of Como Bluffs)	17.0	7.6	79
Laramie	16.6	7.4	77
Rawlins	16.6	7.4	77
Rock Springs	15.9	7.1	74
Wheatland Reservoir	15.9	7.1	74
Casper	15.7	7.0	73
Medicine Bow Airport	15.2	6.8	71
Red Desert	9.6	4.3	45

[1] Martner (1981).

Table 1.2 Comparison of Cost per kWh for Selected Energy Resources.

Energy Resource	Cost (cents/kWh)
Wind Energy (Foote Creek Rim and Simpson Ridge areas)[1]	3.2-3.7[2]
Coal (new construction, including capital, fuel, and O&M costs)	4-5[3]
Natural gas-fired combustion turbines (new construction, fuel, and O&M costs)	3-5
Hydropower (new construction)	4-7
Geothermal	5-8
Biomass (burning plant matter)	6-8
Solar/thermal	10-12
Photovoltaic	30-40

[1] Does not include transmission costs, but includes the 1.5 cent Production Tax Credit.
[2] Calculated on a "real levelized" basis (i.e., averaged over the LOP and discounted for inflation to 1993 dollars).
[3] Regan (1993).

authority of the Federal Land Policy and Management Act of 1976. The BLM GDRA Resource Management Plan (RMP) (BLM 1990a) indicates that public lands within the KENETECH Windplant project area are suitable for Windplant development, subject to certain stipulations. Under the BLM's Lands Program (BLM 1987:42-45), public lands in the GDRA are available for use by utility and transportation systems, with stipulations to protect certain important natural resources when siting generation or utility and transportation systems. This EIS is tiered to the RMP, which will be referenced as appropriate.

The Pacific Northwest Electric Power Plan and Conservation Act (Northwest Power Act) provides the framework for regional energy resource planning by the BPA. The Northwest Power Act authorizes BPA to acquire experimental, developmental, or pilot projects that have potential for providing cost-effective service to BPA's customers. Under the Northwest Power Act, the Northwest Power Planning Council (Council) develops a regional conservation and electric power plan. Every two years, BPA develops a Resource Program to translate the Council plan into a specific set of near-term actions with associated budgets.

An objective of the Council's 1991 Power Plan is to determine the cost and availability of new cost-effective resources, such as wind energy, through research and demonstration programs. BPA's 1992 Resource Program recognized the Resource Supply Expansion Program (RSEP) as the primary mechanism to achieve this objective. Through the RSEP, a windpower strategy was developed that acknowledged BPA should help host utilities develop small-scale wind demonstration projects. Implementing the windpower strategy would enable the Northwest to address regional barriers to cost effective wind development and to gain hands-on experience with the operation and integration of commercial windfarms.

In September 1992, BPA issued a *Request for Proposals (RFP) for a Wind Energy Demonstration Project* to implement the RSEP wind strategy. The RFP solicited proposals for utility services only and for the acquisition of output with utility services. Two proposals were accepted, each of which would supply 25 MW to the BPA. A portion (i.e., 25 of the 500 MW) of the Proposed Action described in this EIS is one of the proposals selected; the other proposed project is located in Klickitat County, Washington. Therefore, 25 MW of power from the first phase would serve to meet BPA's goal to demonstrate windpower; the Windplant, however, would be a full-scale industrial electric power generating facility.

1.2.2 Other Policies, Plans, and Programs

The proposed project would also be in conformance with management decisions promulgated in the Carbon County Land Use Plan (Carbon County Planning and Development Commission 1983) and the Wyoming State Land Use Plan (Wyoming State Land Use Commission 1979).

1.3 AUTHORIZING ACTIONS

Table 1.3 lists all authorizing actions required for project compliance with all relevant federal, state, and local laws. In addition to this EIS and associated decision documents, the BLM would issue a ROW permit to construct the Windplant on federal lands. Prior to construction of each phase of the project, the BLM would issue an NTP. Power line and road ROWs on BLM-managed lands would be issued under the authority of Title V of the Federal Land Policy Management Act of 1976. Access roads would be authorized through the NTP and would conform to special stipulations for project area lands. Common stipulations include provisions for the protection of:

- wildlife resources,
- threatened and endangered (T&E) species,
- cultural resources,
- paleontological resources,
- wetland/riparian areas,
- current land uses,

Table 1.3 Federal, State, and County Authorizing Actions.

Agency	Action	Authority
U.S. Bureau of Land Management	EIS preparation	NEPA, 40 C.F.R. Parts 1500-1508; Federal Land Policy and Management Act of 1976 (as amended), Public Law 94-579.
	ROW grant	U.S. Department of Interior/Department of Agriculture/Department of Transportation P.L. 96-487 Federal Register Notice 6-3-81.
	NTP	BLM Manual H-2801-1 ROW PODs.
U.S. Bonneville Power Administration	EIS preparation Execute Power Purchase Agreement	Public Law 96-501.
U.S. Environmental Protection Agency	Oversee NEPA and all permitting processes	See federal authorities for other agencies.
	Permit treatment, storage, or disposal of hazardous wastes	Resources Conversation and Recovery Act.
U.S. Fish and Wildlife Service	Review impact on federally listed or proposed T&E species of fish, wildlife, plants, and migratory birds	Fish and Wildlife Coordination Act of 1934, as amended 1946, 1958, 1977 (16 U.S.C. 661-667e); Endangered Species Act of 1973 (16 U.S.C. Sections 1531 et seq.); Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 et seq.); Eagle Act (16 U.S.C. 668-668d).
U.S. Army Corps of Engineers	Section 404 Permit for placement of dredged or fill material into waters of the United States	Section 404, Clean Water Act of 1977, amended 1987 (33 U.S.C. Sections 1251-1376).
Wyoming Game and Fish Department	Review impact on T&E species, wildlife, and wildlife habitat	Fish and Wildlife Coordination Act of 1934, as amended 1946, 1958, 1977 (U.S.C. 661-667e).
Wyoming Department of Environmental Quality		
Industrial Siting Council	Issue industrial siting permit	Industrial Siting Act W.S. 35-12-101 through 119.
Water Quality Division	Section 401 certification for stream crossings	Clean Water Act of 1977, amended 1987 (33 U.S.E. Sections 1251-1376).
	Issue stormwater discharge permit	Clean Water Act of 1977, amended 1987 (33 U.S.E. Sections 1251-1376); Wyoming Water Quality Rules and Regulations Chapter XVIII.
	Notification of accidental release of hazardous substances into waters of the state	W.S. 35-11-301 and 35-11-302.
Wyoming Public Service Commission	Issue of a Certificate of Public Convenience and Necessities	Wyoming Administrative Procedure Act, W.S. 9-4-101 through 9-4-115, and the Wyoming Public Utilities Act, W.S. 37-1-101 through 37-3-114, 37-6-101 through 37-6-107, and 37-8-101 through 37-12-213.
Wyoming State Historic Preservation Office	Consult with BLM on site eligibility and the effects of the project on eligible sites	National Historic Preservation Act of 1966, as amended (16 U.S.C. 470).
Carbon County	Issue special use permit	Carbon County Rules and Regulations Section 312.9.
	Issue building permit	Carbon County Rules and Regulations Section 312.9.

- water resources, and
- visual resources.

1.4 ISSUES AND CONCERNS

In January 1994, a scoping statement was mailed to government agencies, municipalities, Native American Tribes, grazing permittees, lease operators, industry representatives, environmental organizations, and other agencies and individuals having a potential interest in the proposed project. Local and regional media also received the scoping statement and a press release. The scoping statement explained the proposed project and requested comments regarding issues and concerns that should be addressed in the EIS. Comment letters were accepted until February 25, 1994. Thirty-three written comments and 11 telephone calls were received. A list of respondents is presented in Table 1.4. All written and verbal comments on the proposed project are considered in this EIS.

Issues and concerns identified by the public, BLM, and other governmental organizations regarding the Proposed Action and analyzed in this EIS are as follows:

Key issues

- wind turbine effects on birds,
- direct and indirect wildlife habitat loss,
- big game winter range and migrations,
- threatened, endangered, candidate, or state sensitive (TEC&S) and priority plants and animals and their habitats,
- cultural resources and Native American spiritual values, and
- reasonable access to public land.

Other issues and concerns

- visual resources and aesthetics,
- benefits/disadvantages of wind energy vs. other energy sources,
- noxious weed control,
- highly erodible and unstable soils,
- wetlands and riparian areas,
- paleontological resources,
- reclamation potential,
- surface and groundwater,
- conformance with current and future land uses,
- compatibility with management plans and objectives,
- noise impacts on residents and wildlife,
- impacts to recreation (e.g., hunting and access),
- social and economic effects on local communities,
- revenue generation and job availability,
- areawide transmission capabilities,
- impacts to existing pipelines,
- impacts to other potential wind developers,
- compatibility with other energy industries,
- increased traffic on roads and increased human activity, and
- public safety, law enforcement, and travel management.

This EIS was prepared by a third-party contractor [Mariah Associates, Inc. (Mariah), Laramie, Wyoming], with the BLM (Rawlins District Office and GDRA Office, Rawlins, Wyoming) as the lead agency and the BPA as a cooperating agency providing guidance, input, participation, and independent evaluation. The BLM and BPA, in accordance with 40 C.F.R. 1506.5 (a) and (b), are in agreement with the findings of the analysis and approve and take responsibility for the scope and content of this document.

Table 1.4 Scoping Responses.

CITIZENS GROUPS	**INDIVIDUALS**
Audubon Society	Carolyn Duncan
Carbon County Coalition	Agnes Howard
Environmental and Cultural Organization Systems	Mary E. King
Native Ecosystems Council and Friends of the Bow	Mark Ledder
Sierra Club	Kenneth Rehmeier
Wyoming Outdoor Council	Raymond E. Spackman
Wyoming Wildlife Federation	Ronald Wiggins
GOVERNMENTAL AGENCIES	**INDUSTRY**
Federal	Carbon Power and Light, Inc.
Northwest Power Planning Council	Colorado Interstate Gas Company
U.S. Fish and Wildlife Service	Edison Development Company
Western Area Power Administration	Horizons West, Inc.
State of Wyoming	Louisiana Power Corporation
State Historic Preservation Office	Northern Gas Company
Wyoming Department of Environmental Quality	SeaWest, Inc.
Wyoming Game and Fish Department	Snyder Oil Corporation
Wyoming Geological Survey	Williams Natural Gas Company
Wyoming Public Service Commission	Wiltel, Inc.
Wyoming State Engineers' Office	**NATIVE AMERICAN TRIBES**
Other	Northern Arapaho Tribe
Carbon County Economic Development Corporation	Eastern Shoshone Tribe
Carbon County Weed and Pest Control Board	Oglala Lakota Nation
New York State Department of Environmental Conservation	Northern Cheyenne Tribe
Town of Rock River	

2.0 PROPOSED ACTION AND ALTERNATIVES

The environmental analysis for the proposed Windplant project includes an assessment of the Proposed Action and two alternatives, including a No Action Alternative.

The Proposed Action would involve construction of a 500-MW Windplant, in phases, in the Foote Creek Rim and Simpson Ridge areas, between Arlington and Hanna, in Carbon County, Wyoming (see Maps 1.1 and 1.2). The fully-constructed Windplant would consist of approximately 1,390 wind turbine generators (WTGs) and associated facilities (see Section 2.1). A 230-kV transmission line also would be constructed from one or more Windplant substations to PacifiCorp's Miner's substation near Hanna to connect the proposed Windplant to the western U.S. power grid. Three alternate transmission line routes will be analyzed as part of the Proposed Action and Alternative A (Map 1.2), and one will be selected following the environmental analysis.

Alternative A would involve construction of a 300-MW Windplant within the Foote Creek Rim and Simpson Ridge project areas. The Windplant would consist of approximately 835 WTGs and associated facilities, including a 230-kV transmission line from Windplant substations to the Miner's substation.

Under the No Action Alternative, the ROW grants would not be granted, and the Windplant and transmission line would not be constructed.

The KENETECH/PacifiCorp project area (KPPA) is defined as the Foote Creek Rim and Simpson Ridge project areas plus all three alternate transmission line routes [100.0-ft (30.5-m) wide ROW]. The total acreage of new disturbances expected under the Proposed Action and under Alternative A and the acreage of existing roads to be used under these actions are shown in Table 2.1.

2.1 PROPOSED ACTION

2.1.1 Overview

Under the Proposed Action, the BLM would issue a 30-year, renewable ROW grant to KENETECH to construct a 500-MW Windplant on public land in the Foote Creek Rim and Simpson Ridge areas between Hanna and Arlington in Carbon County (Maps 1.1 and 1.2). The Windplant would be constructed on a mixture of federal (28%), state (10%), and private land (62%). KENETECH has obtained easements from the private landowners to construct and operate the Windplant and has applied for an easement from the Wyoming State Lands Commission to lease state lands. Because the proposed project area is within an area of "checkerboard" landownership (a pattern of alternating federal, state, and private land), the use of federal land is needed for optimal Windplant development. The use of federal land in addition to state and private land is essential to the effective completion of the project because:

- more turbines could be erected for increased renewable power generation,
- turbines could be efficiently located for increased renewable power generation, and
- turbine placement could be more easily varied to minimize environmental impacts.

The Windplant would be connected to the western U.S. power grid via a 230-kV transmission line from Windplant substations in the Foote Creek Rim and Simpson Ridge areas to PacifiCorp's Miner's substation near Hanna. Under the Proposed Action, the BLM would issue a separate ROW grant to PacifiCorp to construct the transmission line. There are three proposed alternate transmission line routes (Map 1.2), each crossing a mixture of federal, state, and private land. All three routes are analyzed in this EIS as part of the Proposed Action. The final route would be selected by the BLM in the ROD for the final EIS.

Table 2.1(a) Types and Acreages of Proposed Disturbance.[1]

	Proposed Action (ac)[2]								Alternative A[3] (ac)	
	Phase 1 70.5 MW		Foote Creek Rim 200 MW		Simpson Ridge 300 MW		Full Windplant 500 MW		300 MW	
Disturbance Type	Initial	LOP[4]	Initial	LOP	Initial	LOP	Initial	LOP	Initial	LOP
Windplant										
Turbine string corridors (pads, trenches, and roads)	92	38	270	112	670	279	940	392	564	235
New road ROWs (outside corridor)	32	16	73	37	449	224	522	261	313	157
Existing roads[5]	0	10	0	23	0	26	0	49	0	29
Collection line ROWs	12	0	27	0	106	0	133	0	82	0
Subtotal	136	64	370	172	1,225	529	1,595	702	957	421
Substations										
Windplant substations	3	3	3	3	9	9	12	12	9	9
Miner's substation expansion	1	1	1	1	0	1	1	1	1	1
Subtotal	4	4	4	4	9	10	13	13	10	10
230-kV Transmission Line Route No. 3[6]										
Transmission line ROW	178	0	178	0	0	0	178	0	178	0
Staging areas	1	0	1	0	0	0	1	0	1	0
Subtotal	179	0	179	0	0	0	179	0	179	0
Total disturbance[7] (to nearest ac)	319	68	553	176	1,234[8]	539	1,787	715	1,146	431

[1] Assumptions used to compute acreages are shown in Table 2.1(b).
[2] Multiply number of ac by 0.4047 to compute number of hectares.
[3] Assumes disturbance from Alternative A would equal 60% of disturbance from the full Windplant.
[4] The BLM would issue a 30-year ROW grant which may be renewed indefinitely if the project is approved. The LOP, therefore, is expected to be 30 years or more.
[5] Existing roads used to access the Windplant are considered only as part of the LOP disturbance.
[6] Alternate 3 is included in these calculations because it is the longest proposed transmission line route, and therefore, would have the most disturbance. A comparison of disturbance acreage among the three alternate transmission line routes is shown in Table 2.1(c).
[7] The existing Miner's substation, PacifiCorp transmission line network, and telephone lines are permanent functional facilities whether or not the Windplant is constructed; therefore, the acreage of existing disturbance from these facilities is not included.
[8] Does not include disturbance due to the 230-kV transmission line or Miner's substation expansion because these disturbances would occur with the development of Phase I.

Table 2.1(b) Assumptions Used to Compute Acreages in Table 2.1(a).

	Proposed Action							
	Phase 1 70.5 MW		Foote Creek Rim 200 MW		Simpson Ridge 300 MW		Full Windplant 500 MW	
Disturbance Type	Initial	LOP	Initial	LOP	Initial	LOP	Initial	LOP
Turbine corridor [length, mi (km)]	6.3 (10.1)	6.3 (10.1)	18.6 (29.9)	18.6 (29.9)	46.1 (74.2)	46.1 (74.2)	64.6 (103.9)	64.6 (103.9)
Turbine corridor [width, ft (m)][1]	120.0 (36.6)	50.0 (15.2)	120.0 (36.6)	50.0 (15.2)	120.0 (36.6)	50.0 (15.2)	120.0 (36.6)	50.0 (15.2)
New road outside corridor [length, mi (km)]	5.5 (8.9)	5.5 (8.9)	12.6 (20.3)	12.6 (20.3)	77.1 (124.0)	77.1 (124.0)	89.7 (144.4)	89.7 (144.4)
New road outside corridor [width, ft (m)][2]	48.0 (14.6)	24.0 (7.3)	48.0 (14.6)	24.0 (7.3)	48.0 (14.6)	24.0 (7.3)	48.0 (14.6)	24.0 (7.3)
Existing roads [length, mi (km)]	0.0 (0.0)	1.8 (2.9)	0.0 (0.0)	4.0 (6.4)	0.0 (0.0)	4.5 (7.2)	0.0 (0.0)	8.5 (13.7)
Existing roads [width, ft (m)][2]	0.0 (0.0)	48.0 (14.6)	0.0 (0.0)	48.0 (14.6)	0.0 (0.0)	48.0 (14.6)	0.0 (0.0)	48.0 (14.6)
Overhead collection line [length, mi (km)]	5.0 (8.0)	5.0 (8.0)	11.0 (17.7)	11.0 (17.7)	44.0 (70.8)	44.0 (70.8)	55.0 (88.5)	55.0 (88.5)
Overhead collection line [width, ft (m)][3]	20.0 (6.1)	0.0 (0.0)	20.0 (6.1)	0.0 (0.0)	20.0 (6.1)	0.0 (0.0)	20.0 (6.1)	0.0 (0.0)

1 **Turbine corridor width is the average width of the corridor containing turbine pads, buried cables, and roads.**

2 **Assumes that an average width of 48.0 ft (14.6 m) would be disturbed during all road construction, and that approximately 24.0 ft (7.3 m) would be reclaimed following construction. Assumes that disturbance along existing roads averages 48.0 ft (14.6 m).**

3 **Assumes an average disturbance width of 20.0 ft (6.1 m) during overhead line construction and complete ROW reclamation following construction.**

Table 2.1(c) Comparison of Disturbance Acreages of Alternate Transmission Line Routes 1, 2, and 3.

Disturbance Type	Alternate 1	Alternate 2	Alternate 3
Transmission line [length, mi (km)]	25.6 (41.2)	24.3 (39.1)	29.3 (47.2)
Transmission line [width, ft (m)][1]	50.0 (15.2)	50.0 (15.2)	50.0 (15.2)
Structures (number)[2]	204	194	234
Staging areas (number)	9	8	10
Staging areas (ac per staging area)	0.1	0.1	0.1
Total initial disturbance (ac)	156	148	179
Total final disturbance (ac)	0	0	0

1 Based on an initial disturbance width of 50.0 ft (15.2 m). Initial disturbance along the route is expected to be 12.0 ft (3.7 m) wide, but may be more in some areas. An initial disturbance width of 50.0 ft (15.2 m) represents a worst-case estimate of the amount of disturbance.

2 Assumes that structure construction would occur entirely within the 50.0-ft (15.2-m) disturbance area.

The Windplant would consist of approximately 1,390 WTGs and associated facilities. WTGs would be supported by 80 to 120 ft (24 to 37 m) modified tubular towers spaced approximately 162 to 216 ft (49 to 66 m) apart with approximately 1,080 to 1,620 ft (329 to 494 m) between rows. Support facilities would include step up transformers, substations, underground and overhead power collection and communication lines, PacifiCorp's transmission line, communications systems, roads, and O&M facilities.

The project would be constructed in phases of varying size, beginning with the first phase erection of approximately 201 turbines with an expected generating capacity of 70.5 MW on Foote Creek Rim (Map 2.1). The 230-kV transmission line to Miner's substation would be constructed concurrently with the first phase. Subsequent phases averaging 50 to 100 MW each would be built during the next 10 to 12 years in the Foote Creek Rim and Simpson Ridge areas until the total generating capacity of 500 MW is achieved [up to 200 MW (approximately 575 WTGs), including the 70.5-MW first phase, from the Foote Creek Rim site and at least 300 MW (approximately 815 WTGs) from the Simpson Ridge area].

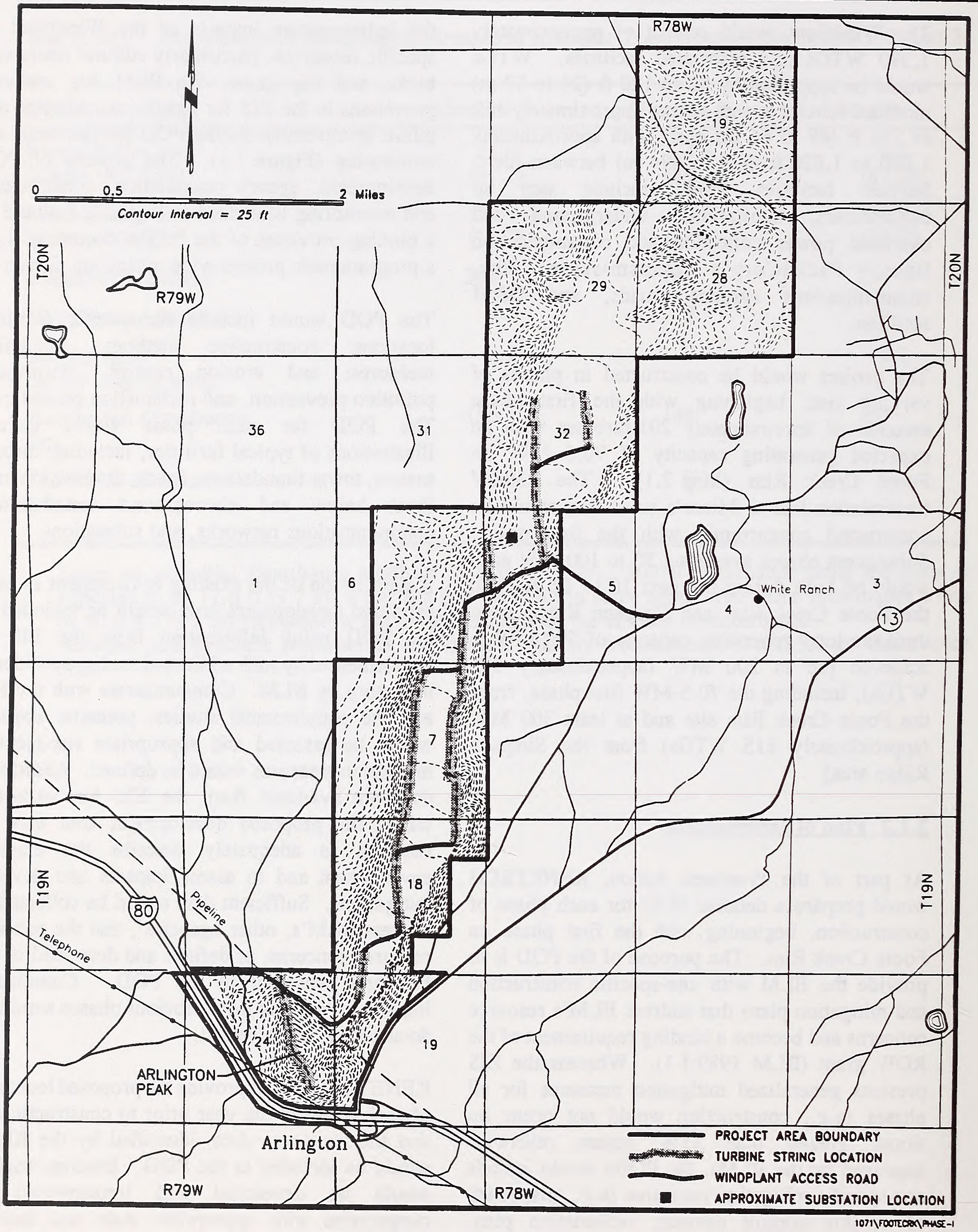
2.1.2 Plan of Development

As part of the Proposed Action, KENETECH would prepare a detailed POD for each phase of construction, beginning with the first phase on Foote Creek Rim. The purpose of the POD is to provide the BLM with site-specific construction and mitigation plans that address BLM's resource concerns and become a binding requirement of the ROW grant (BLM 1989:I-1). Whereas the EIS presents generalized mitigation measures for all phases (e.g., construction would not occur on slopes greater than 25%, unless otherwise approved by the BLM), the PODs would include site-specific mitigation measures (e.g., placement of erosion control devices, reclamation plan, devices/techniques for minimizing bird mortality, cultural resources mitigations, etc.). Because of the indeterminate impacts of the Windplant on specific resources, particularly cultural resources, birds, and big game, the BLM has included provisions in the EIS for agency consultation and public involvement during POD development and monitoring (Figure 2.1). The process of POD development, agency consultation, construction, and monitoring illustrated in Figure 2.1 would be a binding provision of the NEPA document (i.e., a programmatic project-wide mitigation measure).

The POD would include site-specific facilities locations; construction methods; mitigation measures; and erosion control, stormwater pollution prevention, and reclamation procedures. The POD for each phase would include illustrations of typical facilities, including turbine towers, tower foundations, roads, distribution lines (both below and aboveground installations), communications networks, and substations.

A description of the existing environment in each proposed development area would be included in the POD using information from the EIS as supplemented by such additional studies considered necessary by BLM. Commensurate with the EIS and the supplemental studies, potential impacts would be assessed and appropriate site-specific mitigation measures would be defined. Additional data not available from the EIS for resources within the proposed development area may be required to adequately describe the existing environment and to assess impacts and develop mitigations. Sufficient data would be collected to address BLM's, other agencies', and the public's resource concerns, as defined and described in the EIS and evaluated in the POD. Cumulative impacts on wildlife from previous phases would be documented and assessed.

KENETECH would provide the proposed locations of each phase in the year prior to construction so that the necessary data, identified by the BLM, would be included in the POD. Baseline studies would be developed and implemented in cooperation with appropriate state and federal agencies [e.g., the Wyoming Game and Fish Department (WGFD), the Wyoming Department



Map 2.1 Proposed Locations of Turbine Strings and Access Roads for the First Phase of Windplant Development on Foote Creek Rim.

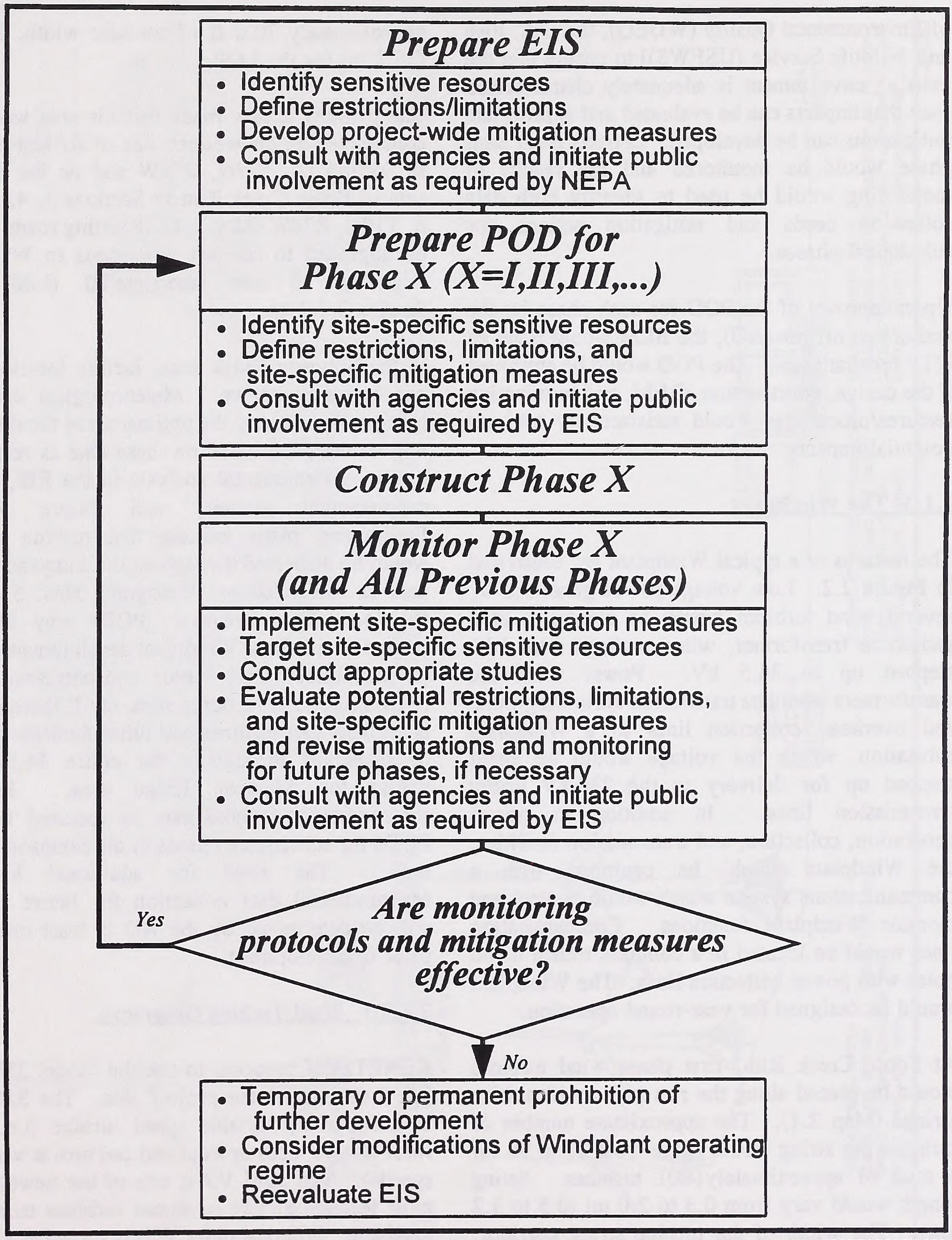


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Figure 2.1 Flow Chart Showing How the Environmental Review Process and Agency Consultation Would Be Utilized as Part of the Proposed Action or Alternative A.

of Environmental Quality (WDEQ), the U.S. Fish and Wildlife Service (USFWS)] to ensure that the existing environment is adequately characterized such that impacts can be evaluated and appropriate mitigations can be developed. Impacts from each phase would be monitored and the results of monitoring would be used to identify both data collection needs and mitigation actions for subsequent phases.

Upon approval of the POD for each phase by the authorized officer (AO), the BLM would issue an NTP for that phase. The POD would be approved if the design, construction, O&M, and termination features/procedures would satisfactorily mitigate potential impacts.

2.1.3 The Windplant

The features of a typical Windplant are illustrated in Figure 2.2. Low voltage power generated by several wind turbines would be combined at a padmount transformer, where voltage would be stepped up to 34.5 kV. Power from the transformers would be transferred via underground and overhead collection lines to a Windplant substation, where the voltage would be again stepped up for delivery to the 230-kV utility transmission lines. In addition to power generation, collection, and transmission facilities, the Windplant would be equipped with a communications system which would control and monitor Windplant functions. Communication lines would be located in a common trench or on poles with power collection lines. The Windplant would be designed for year-round operation.

At Foote Creek Rim, first phase wind turbines would be placed along the rim in 9 to 10 turbine strings (Map 2.1). The approximate number of turbines per string would range from 11 to 56 for a total of approximately 201 turbines. String length would vary from 0.3 to 2.0 mi (0.5 to 3.2 km). The width of the turbine string corridor, including turbine tower pads, buried cables, and roads (Figure 2.3) would be 120.0 ft (36.6 m) during construction and, after restoration of approximately 70.0 ft of corridor width, 50.0 ft (15.2 m) for the LOP.

The primary access roads for this area would be constructed on the western side of Arlington Peak in Section 24, T19N, R79W and on the eastern side of Foote Creek Rim in Sections 3, 4, 5, and 6, T19N, R78W (Map 2.1). Existing roads would be upgraded to connect new roads to Wyoming Highway 13 and Interstate 80 (I-80) (see Section 2.1.3.4).

In the Simpson Ridge area, facility locations are not currently known. Meteorological data are being collected, and the optimal array for this area will be designed based on these data as restricted by the environmental analysis in the EIS, future supplemental studies, and future PODs. Preliminary plans indicate that turbine strings would be dispersed throughout the Simpson Ridge area as illustrated on Photograph Nos. 5 and 6 (Section 4.6). However, PODs may identify critical areas where Windplant development would be prohibited [e.g., raptor concentration areas (RCAs), cultural resource sites, etc.]; therefore, it is unlikely that turbines and other facilities would be dispersed throughout the entire 54,893 ac within the Simpson Ridge area. Further environmental analysis may be required for the PODs for subsequent phases in the Simpson Ridge area. The need for additional baseline environmental data collection for future phases will be determined by the AO at least one year prior to development.

2.1.3.1 Wind Turbine Generators

KENETECH proposes to use the Model 33M-VS WTG throughout the project area. The 33M-VS is an upwind, variable speed turbine (i.e., the rotor always faces upwind and can turn at variable speeds). The 33M-VS is one of the newest and most technologically advanced turbines currently available. Whereas older WTGs turned at a fixed speed, the 33M-VS may turn at variable speeds to more efficiently capture wind energy. Power electronics convert asynchronous power to alternating current (AC) power for delivery to

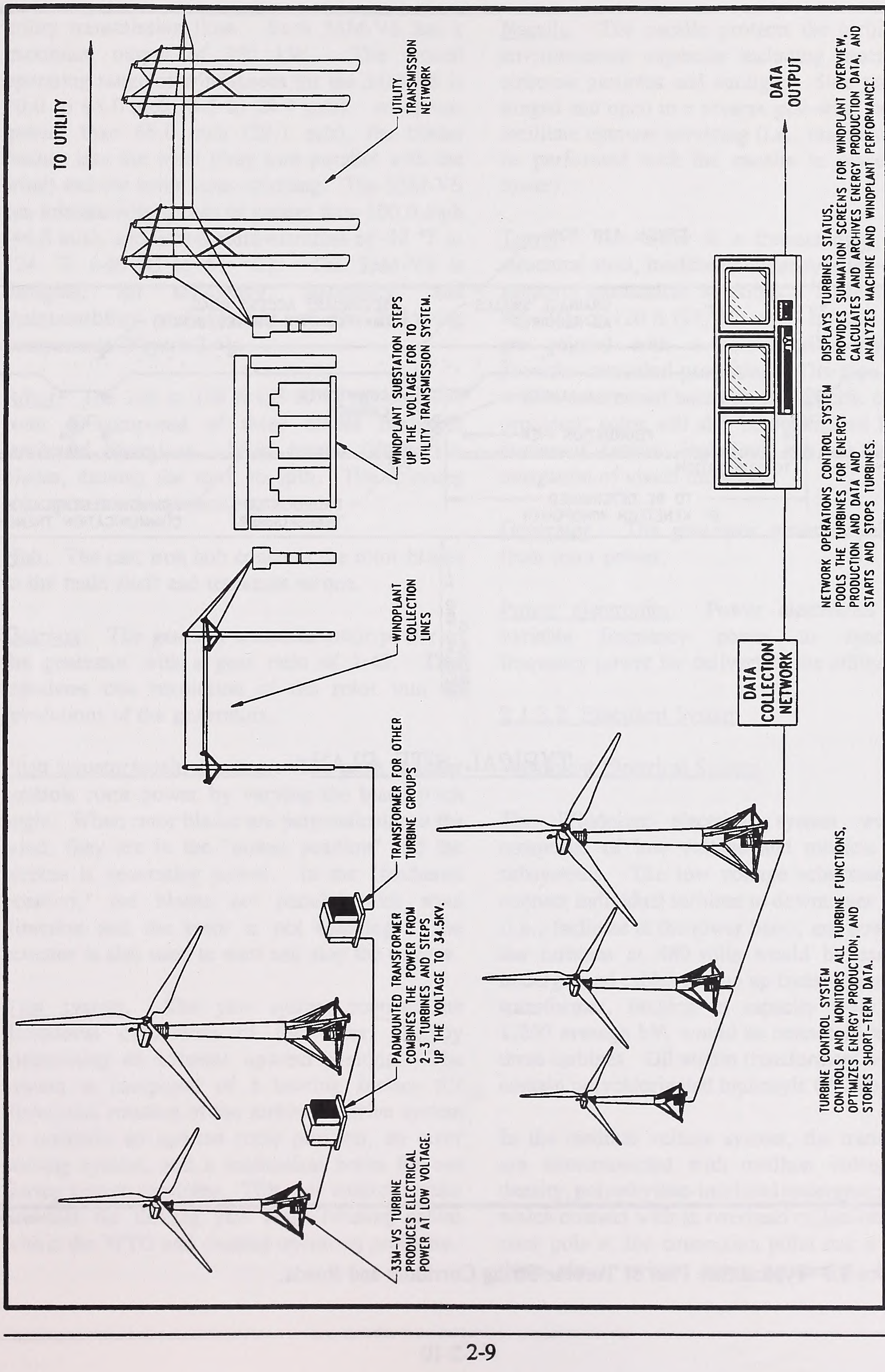


Figure 2.2 Components of a Typical 33M-VS Windplant.

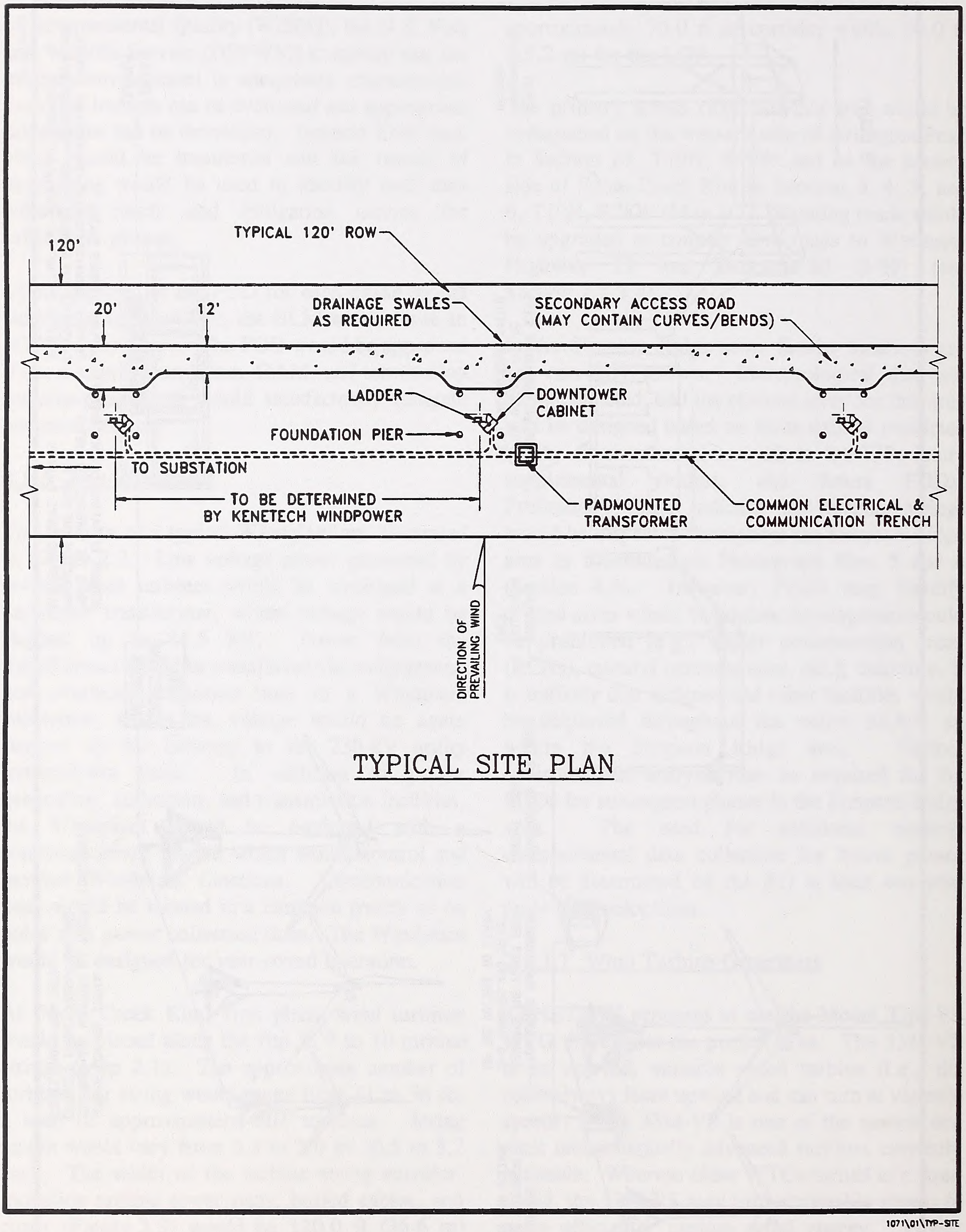


Figure 2.3 Typical Site Plan of Turbine String Corridors and Roads.

utility transmission lines. Each 33M-VS has a maximum output of 350 kW. The typical operating range of windspeeds for the 33M-VS is 10.0 to 65.0 mph (4.5 to 29.1 m/s). At speeds greater than 65.0 mph (29.1 m/s), the blades feather into the wind (they turn parallel with the wind) and the rotor stops spinning. The 33M-VS can tolerate windspeeds of greater than 100.0 mph (44.8 m/s), and temperature extremes of -32 °F to 124 °F (-40 °C to 51 °C). The 33M-VS is designed for efficiency, durability, and maintainability and consists of the following components (Figure 2.4):

Rotor. The 108 to 130 ft (33 to 39 m) diameter rotor is composed of three blades made of laminated fiberglass. Wind creates lift on the blades, causing the rotor to spin. The spinning rotor powers the generators.

Hub. The cast iron hub connects the rotor blades to the main shaft and transmits torque.

Gearbox. The gearbox transmits rotor power to the generator with a gear ratio of 1:45. This translates one revolution of the rotor into 45 revolutions of the generators.

Pitch actuator/position sensor. The pitch actuator controls rotor power by varying the blade pitch angle. When rotor blades are perpendicular to the wind, they are in the "power position" and the turbine is generating power. In the "feathered position," the blades are parallel with wind direction and the rotor is not spinning. The actuator is also used to start and stop the turbine.

Yaw system. The yaw system controls the directional orientation of the rotor, thereby maintaining an accurate upwind position. The system is composed of a bearing surface for directional rotation of the turbine, a drive system to maintain an upwind rotor position, an error sensing system, and a mechanical brake for use during system servicing. This yaw control system prevents the turning yaw from twisting cables within the WTG and causing operating problems.

Nacelle. The nacelle protects the turbine from environmental exposure including precipitation, airborne particles and sunlight. Side panels are hinged and open in a reverse gull-wing fashion to facilitate uptower servicing (i.e., maintenance can be performed with the nacelle in place on the tower).

Tower. The tower is a free-standing, painted structural steel, modified tubular-type tower which supports mechanical workings. Towers will be 80, 100, or 120 ft (24, 30, or 37 m) tall. Towers are painted with a nonreflective finish that provides corrosion protection. The type of paint will be determined based on site-specific corrosion problems; color will also be determined based on numerous factors, including, but not limited to mitigation of visual impacts.

Generator. The generator generates electricity from rotor power.

Power electronics. Power electronics convert variable frequency power to synchronous frequency power for delivery to the utility system.

2.1.3.2 Electrical System

Windplant Electrical System

The Windplant electrical system would be composed of low voltage and medium voltage subsystems. The low voltage subsystem would connect individual turbines to downtower facilities (i.e., facilities at the tower base), and power from the turbines at 480 volts would be carried on underground cables to step up transformers. Each transformer, ranging in capacity from 750 to 1,250 average kV, would be connected to two or three turbines. Oil within transformers would not contain polychlorinated biphenyls (PCBs).

In the medium voltage system, the transformers are interconnected with medium voltage, high density, polyethylene-insulated underground cables which connect with an overhead collection line. A riser pole at the connection point has a pole-top three phase switch, surge protection, insulated

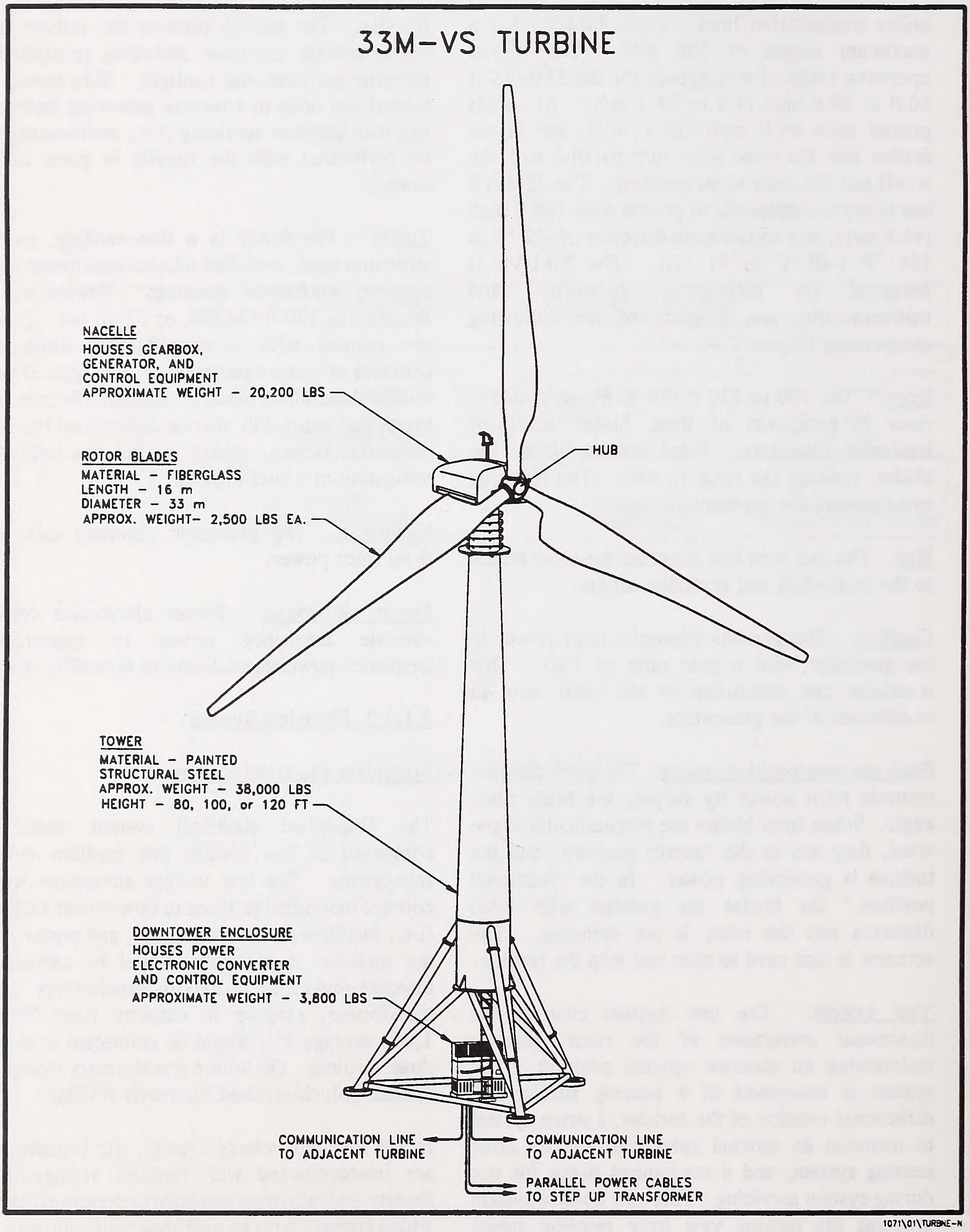


Figure 2.4 Diagram of a Typical Tubular Tower-supported 33M-VS Wind Turbine Generator.

cable terminations and jumper wires, and wildlife boots (a protective covering over any portion of a cable, wire, or connector). From the connection point, power would be transmitted via a collection system consisting of four conductors strung on wooden poles. Conductors will be spaced at least 5.0 ft (1.5 m) apart to minimize potential for raptor electrocution; the fourth conductor is the ground wire for the Windplant. These poles also would be used to support communications cables.

The overhead pole lines would deliver power to the Windplant substations, where voltage would again be stepped up for delivery to the high voltage (230-kV) PacifiCorp transmission line.

Utility Electrical System

The PacifiCorp utility electrical system would consist of a 230-kV transmission line, three to four Windplant substations, and portions of the Miner's substation where the power would be wheeled into PacifiCorp's existing power system. The three alternate transmission line routes (Map 1.2) involve identical construction materials, methods, and design.

The transmission line would be approximately 24.3 to 29.3 mi (39.1 to 47.2 km) long (depending on the route selected) within a 100.0-ft (30.5-m) ROW. Structures would be H-frame design with wooden poles with an installed height of 70.0 to 100.0 ft (21.3 to 30.5 m). Distance between structures would average 800.0 ft (244.0 m), but maximum spans of 1,700.0 ft (518.2 m) are possible under optimum terrain conditions. An estimated eight structures per mi (5 per km) would be needed, for a total of 194 to 234 structures.

The substation for the Foote Creek Rim portion of the Windplant would be located in Section 5, T19N, R78W. The substation would house transformers and other facilities to step up medium voltage power from the Windplant collection lines to high voltage for delivery to the 230-kV transmission line. The substation would be similar to substations typically used on transmission systems in the region and would be approximately 355.0 x 355.0 ft (108.2 x 108.2 m) in size. Small concrete foundations would be constructed for transformers and other components within the substation, but the majority of the yard would be covered with crushed rock. The substation would be fenced with a 7.0-ft (2.1-m) high chain-link fence topped with three strands of barbed wire, for a total fence height of 8.0 ft (2.4 m). Access gates would be locked at all times and warning signs posted for public safety. No other substations would be constructed on Foote Creek Rim. In the Simpson Ridge area, two to three substations similar to the Foote Creek Rim substation would be constructed. These substation locations have not yet been determined.

The new 230-kV transmission line would terminate at a dedicated breaker position at Miner's substation. Miner's substation would be enlarged by approximately 1 ac to accommodate the additional facilities needed for the connection. Fencing and facilities similar to the existing substation and Windplant substations would be used.

2.1.3.3 Communications System

Each WTG would contain communications electronics which constantly monitor turbine functions. The system would use proprietary software, new communications cables, and the existing telephone communication network to relay information to the communication center in Livermore, California, or another off-site control center where the entire Windplant would be monitored.

Information from each turbine would be transferred via cables to downtower communication boxes (Figure 2.4). Data from several turbines would be transmitted via underground cables to data collection equipment, where the cables would connect to the riser poles used for electrical collection lines. Underground communication cables typically would be buried in the same trenches used for power collection lines, so there would be no additional disturbance along turbine strings due to the communication system.

Similarly, overhead communications lines would be installed primarily on the structures used for overhead power collection lines. Overhead communications lines would be routed to a central Windplant collection and transmission facility interconnecting to telephone lines. The information would then be transmitted via existing leased telephone lines to the communication center in Livermore, California, or another off-site control center. For Phase I, two to three communications structures would be constructed near telephone poles to serve as collection points for communications lines. For the 200-MW portion, about four or five communications structures would be required. Approximately 40 to 50 communications structures would be needed for the full 500-MW Windplant.

2.1.3.4 Access

Access to the area is provided by I-80 and Wyoming Highways 30/287, 13, and 72. Access to Windplant facilities, including individual turbines, will be provided by proposed and existing local and resource roads. Local roads provide the internal access network; resource roads are the spur roads that provide access to turbine strings and individual turbines. Tentatively, the existing road located west of Wyoming Highway 13 which currently services the White Ranch (Map 2.1, Sections 3 and 4, T19N, R78W) would be upgraded to BLM local road standards to provide access primarily for O&M activities. A new road may be constructed through Sections 4, 5, and 6 to the Windplant. The existing road south of I-80 in Section 24 (T19N, R79W) may be upgraded to BLM local road standards and a new road constructed within Section 24 to access the rim top during construction and for O&M. New resource roads would be constructed along turbine strings and in short spurs to access turbines.

Although the exact location and type of each proposed road within the project area cannot currently be determined, proposed roads would be designed and constructed to BLM standards and located to minimize disturbance, avoid sensitive resources (e.g., raptor nests, cultural resource sites), and maximize transportation efficiency.

For the first 70.5-MW phase, approximately 1.8 mi (2.9 km) of existing roads would be upgraded, and 11.8 mi (19.0 km) of new roads (6.3 in the turbine corridor and 5.5 outside of the corridor) would be constructed [Table 2.1(b)]. An additional 2.2 mi (3.5 km) of existing roads would be needed for the 200-MW/Foote Creek Rim portion of the Windplant. The full 500-MW Windplant would require 8.5 mi (13.7 km) of existing roads and 154.3 mi (248.3 km) of new roads.

Site-specific analysis under standard BLM procedures would be conducted on all roads during development, and proper authorizations (i.e., an NTP) would be obtained for all roads prior to construction. Road authorization and use would be coordinated with other users, and roads would be constructed following guidelines specified in the BLM road standards manual, Section 9113 (BLM 1985, 1991).

All roads would be constructed for the specific purpose of Windplant development. Roads would be designed, built, surfaced, and maintained to minimize disturbance and provide safe operating conditions at all times as determined by the BLM.

Site-specific surveys would be conducted prior to disturbance, and roads would be designed and sited to ensure safe operating conditions. Sensitive areas and unsuitable topography would be avoided, where feasible. Permanent roads across both public and private lands would be designed by, or under the direction of, a licensed professional engineer, and road construction would be monitored by qualified personnel, as deemed appropriate by the BLM. All roads would be constructed with adequate drainage and erosion control structures (e.g., relief culverts, drainage culverts, wing ditches, waterbars). To further decrease potential impacts, the number and miles of roads would be limited by accessing tower locations from short spurs off local roads, where feasible. Roads would be closed and reclaimed by

KENETECH when they are no longer required for the project, unless otherwise directed by the BLM, private landowner, or other authorizing agency.

During construction and operations, project-related traffic would be restricted to I-80, State Highways 13 and 72, and roads developed for the project. Use of unimproved roads would be allowed only in emergency situations. KENETECH would instruct project personnel and contractors to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to assure safe and efficient traffic flow. Signs would be placed along roads as directed by the BLM to identify speed limits, travel restrictions, and other standard traffic control information.

All equipment would be maintained in good working order to minimize impacts to air quality and noise and to ensure human safety. In addition, newly developed or improved roads through crucial wildlife areas would be gated and locked at appropriate locations as directed by the BLM to prevent unnecessary wildlife disturbance. Keys would be provided only to essential project personnel (e.g., O&M staff), landowners, and area administrators (e.g., BLM, WGFD, County Sheriff's Office, etc.).

2.1.4 Construction

The proposed project would use standard construction and operation procedures as used for other Windplant development projects in the western United States. These procedures, with minor modifications to allow for site-specific circumstances, are summarized below.

Windplant construction would entail the following activities, listed in order of occurrence:

- road and pad construction;
- drilling foundation footings for towers;
- pouring concrete foundations for turbine towers, meteorological towers, transformer pads, and substations;
- trenching for underground utilities;
- placement of underground electrical and communications cables in trenches;
- overhead electrical power system construction;
- electrical connection to tower;
- tower assembly, erection, and equipment installation;
- final testing; and
- final road grading, erosion control, and site clean up.

Table 2.2 presents a list of construction equipment used for Windplant construction.

2.1.4.1 Road and Pad Construction

Access roads would be constructed according to BLM standards as described in BLM Manual Section 9113 (BLM 1985). Roads would be located to minimize disturbance and maximize transportation efficiency and to avoid sensitive resources and unsuitable topography, where feasible. To avoid sensitive resources that may be found prior to disturbance, BLM and KENETECH may select road locations that may vary from those shown on Map 2.1. All new roads would be constructed for the specific purpose of Windplant development and O&M.

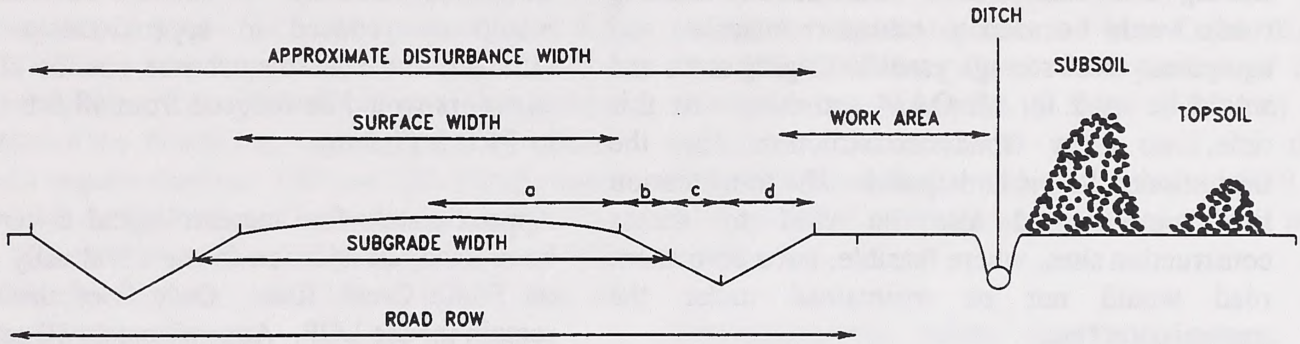
Figure 2.5 shows a typical road section for Windplant access roads. Roads would be built, surfaced, and maintained to provide safe operating conditions at all times as determined by the BLM. Roads in areas of rough terrain or high erosion potential would be designed and monitored by a professional engineer. The minimum full surfaced travelway width for local and resource roads would be 20.0 and 12.0 ft (6.1 and 4.3 m), respectively, and resource roads would have turnouts for opposing traffic (Figure 2.5). Surface disturbance would be contained within road ROWs. ROWs would average 40.0 ft (12.2 m) for resource roads and 48.0 ft (14.6 m) for local roads. Disturbance width would increase in rugged topography due to cuts and fills necessary to construct and stabilize roads on slopes.

Topsoil removed during road construction would be stockpiled in elongated rows within road

Table 2.2 List of Construction Equipment Typically Used for Windplant Construction.

Equipment	Use
D7 bulldozer	Road and pad construction
Grader	Road and pad construction
Water trucks	Compaction, erosion, and dust control
Roller/compactor	Road and pad compaction
Backhoe/trenching machine	Digging trenches for underground utilities
Truck-mounted drilling rig	Drilling tower foundations
Concrete trucks/concrete pumps	Pouring tower and other structure foundations
Cranes	Tower/turbine erection
Dump trucks	Hauling road and pad material
Flatbed trucks	Hauling towers and other equipment
Pickup trucks	General use and hauling minor equipment
Small hydraulic cranes/fork lifts	Loading and unloading equipment
Four-wheeled all terrain vehicles	Rough grade access and underground cable installation
Rough terrain forklift	Lifting equipment

(NOT TO SCALE)



	MINIMUM SUBGRADE WIDTH ft (m)	MINIMUM SURFACED TRAVELWAY WIDTH ft (m)	a ft (m)	b ft (m)	c ft (m)	d ft (m)	APPROXIMATE DISTURBANCE WIDTH ft (m)	ROW WIDTH ft (m)	DESIGN SPEED (mph)
RESOURCE ROAD	16 (5)	12 (4)	6 (2)	2 (.6)	4 (1)	8 (2)	40 (12)	50 (15)	15–30
LOCAL ROAD	24 (7)	20 (6)	10 (3)	2 (.6)	4 (1)	8 (2)	48 (15)	55 (17)	20–50
COLLECTOR ROAD	28 (9)	24 (7)	12 (4)	2 (.6)	4 (1)	8 (2)	52 (16)	60 (18)	30–50

DIAGRAM OF TYPICAL TURNOUTS ON RESOURCE ROADS

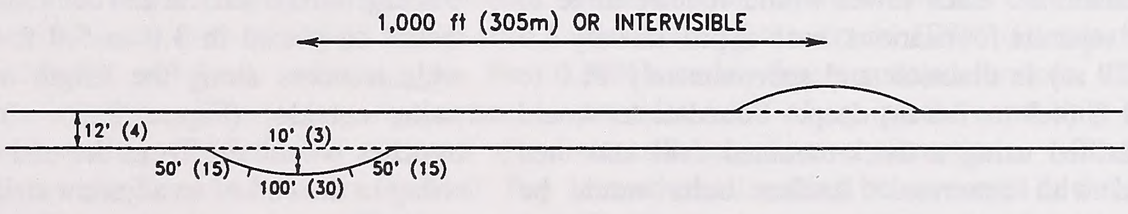


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Figure 2.5 Typical Road Cross Section and Width Specifications for BLM-approved Roads.

ROWs. Topsoil would be respread in cut-and-fill slopes and these areas would be revegetated as soon as possible after road construction.

During transmission line construction, existing roads would be used to transport materials and equipment from storage yards to staging areas and would be used for all O&M activities. At this time, no new road construction for the transmission line is anticipated. The transmission line route would also be used to access construction sites, where feasible, but a permanent road would not be maintained under the transmission line.

During construction and O&M of the Windplant, traffic would be restricted to the roads developed for the project. Use of unimproved roads would be restricted to emergency situations. Speed limits would be set commensurate with road type, traffic volume, vehicle type, and site-specific conditions as necessary to ensure safe and efficient traffic flow. Signs would be placed along the roads, as necessary, to identify speed limits, travel restrictions, and other standard traffic control information.

Turbine pads would be constructed using standard cut-and-fill procedures. All pad construction activities would occur within the turbine string corridor.

2.1.4.2 Foundations and Tower Erection

Turbine towers would be anchor-bolted to concrete foundations. Each tower would require three to four separate foundations, each approximately 3.0 ft (0.9 m) in diameter and approximately 16.0 to 25.0 ft (4.9 to 7.6 m) deep. Foundations would be drilled using a truck-mounted drill and then filled with concrete. Anchor bolts would be embedded in the concrete, and the foundation would be allowed to cure prior to tower erection.

Turbine tower assembly and erection would occur within a 120.0-ft (36.6-m) wide corridor along turbine string locations. No additional staging areas would be needed. The turbine string corridor would consist of tower pads, trenches, and resource roads (Figure 2.3). Following construction, portions of the pads, tower assembly areas, and road ROWs and all trenched areas would be reclaimed. Turbine corridor width would be reduced to approximately 50.0 ft (15.2 m) and road disturbance outside of turbine corridors would be reduced from 48.0 ft (14.6 m) to 24.0 ft (7.3 m).

Approximately five meteorological towers would be erected, in addition to the 19 already in place on Foote Creek Rim. Only 7 of these would remain for the LOP. Approximately 50 permanent meteorological towers would be erected for the full 500-MW Windplant. Meteorological towers [80.0 to 100.0 ft (24.3 to 30.5 m) tall] would be erected, primarily within turbine string corridors, on 3.0-ft (0.9-m) diameter pier foundations. Foundation depth would vary depending on local soil conditions. Foundations would be drilled using a truck-mounted drilling rig and then filled with concrete.

Other facilities requiring foundations would include transformer pads, substations, and O&M and communications facilities. The foundations would be constructed using standard cut-and-fill procedures and pouring concrete in a shallow slab or using a precast structure set on an appropriate depth of structural fill.

2.1.4.3 Trenching and Placement of Underground Electrical and Communications Cables

Underground electrical and communications cables would be placed in 3.0 to 5.0 ft (0.9 to 1.5 m) wide trenches along the length of each turbine string corridor (Figure 2.3). In some cases, trenches would run from the end of one turbine string to the end of an adjacent string to link more turbines together via the underground network. Trenches would be excavated 3.0 to 4.0 ft (0.9 to 1.2 m) deep and electric distribution and communications cables would be placed in the trench using trucks. Electrical cables would be installed first and the trench partially backfilled prior to placement of the communications cables.

Trenches would be backfilled and the area revegetated concurrently with revegetation of other construction areas. For the first phase of Windplant development, an estimated 65 to 100 transformers would be used to step up low voltage power to 34.5 kV and approximately 9.5 mi (15.3 km) of underground power cable would be installed. The 200-MW Foote Creek Rim portion of the Windplant, including the first phase, would require between 190 and 290 transformers and 37.0 mi (59.5 km) of underground cable. The full 500-MW Windplant would use a total of 460 to 700 transformers and 78.0 mi (125.5 km) of underground cable.

2.1.4.4 Overhead Electrical Power and Communications Systems Construction

Underground cables would be collected at the end of each turbine string and connected to a riser pole with an overhead collection line. Collection line construction would entail the following major activities: surveying, ROW preparation, materials hauling, structure assembly and erection, ground wire and conductor stringing, and cleanup and restoration.

All overhead collection line systems would be constructed by KENETECH in conformance with PacifiCorp's standards, the National Electric Safety Code (NESC), the American National Standards Institute, and "*Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1981*" (Olendorff et al. 1981) or any future updated versions. Wooden poles with a 45.0 to 55.0 ft (13.7 to 16.8 m) installed height would be erected at the ends of turbine strings and then at 175.0-ft (53.3-m) intervals to the Windplant substation. Temporary disturbance width would average 20.0-ft (6.1-m), and all disturbance would be confined to a 50.0 ft (15.2 m) ROW. Approximately 175 structures and 5.0 mi (8.0 km) of overhead collection lines would be erected for the first phase of the project. The 200-MW/Foote Creek Rim portion of the Windplant would require 11.0 mi (17.7 km) of overhead collection lines and 492 structures. The 500-MW Windplant would require an estimated 55.0 mi (88.5 km) of overhead collection lines and 2,550 structures.

Approximately 5.0 mi (8.0 km) of aboveground power collection lines (150 poles) would be needed for the first phase at Foote Creek Rim. The 200-MW/Foote Creek Rim portion of the Windplant would require 11.0 mi (17.7 km) of collection lines and 300 poles, and the full 500-MW Windplant would need a total of 50.0 to 60.0 mi (80.0 to 96.5 km) of collection lines and 1,800 poles.

Communications cables for large groups of turbines (100 to 200 turbines) would be combined and routed to a small [8.0 x 4.0 ft (2.4 x 1.2 m)] communications structure for signal processing and retransmission on a telephone cable. Off-site leased telephone lines would be used to connect the Windplant to the communication control center in Livermore, California or another off-site facility. The telephone lines would be located on dual use utility poles or single use poles.

2.1.4.5 230-kV Transmission Line Construction

Transmission line construction would use standard industry procedures and entail the following major activities: surveying, ROW preparation, materials hauling, structure assembly and erection, ground wire and conductor stringing, and cleanup and restoration. The transmission line would be constructed and maintained by PacifiCorp in conformance with the NESC and other applicable codes and standards, as well as "*Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1981*" (Olendorff et al., 1981), or any future updated versions. Table 2.3 provides a list of equipment commonly used for transmission line construction. Construction procedures described below would be the same for all three routes.

The approved ROW centerline would be surveyed and staked by a licensed surveyor, and preliminary structure locations identified. Construction materials would be hauled from temporary storage areas in nearby communities (e.g., Rawlins,

Table 2.3 List of Equipment Typically Used for Transmission Line Construction.[1]

Equipment	Function
Tracked tractor with blade	Remove vegetation from staging areas and along selected portions of the ROW to improve access
Wagon drill mounted on the back of a rubber-tired vehicle	Test for rock prior to drilling pole holes
Drilling rig and auger mounted on the back of a rubber-tired vehicle	Dig pole and anchor holes
Setting crane or cable rig puller pulled by a tracked tractor	Raise and set the structures
Framing truck	Carry crews and materials to assemble the structures
Truck-mounted air compressor with tamps	Tamp backfilled soil around the poles after the structure is in place
Flatbed trucks and pole trailers	Haul crossarm materials and distribute poles
Truck-mounted A-frames	Unload material and erect structures
Forklifts	Unload poles, erect structures, and frame
Truck-mounted high reach	Aerial framing and clipping
Winch truck	Realign structures pulled out of alignment during conductor stringing
Truck-mounted tensioner	String conductor
Truck-mounted cable reels	String conductor
Five to 10 pickup trucks	Transport supervisory and construction crews

[1] PacifiCorp (1994).

Hanna, or Arlington) to staging areas along the ROW or to structure locations. Staging areas would be established at approximately 3.0-mi (4.8-km) intervals along the ROW in relatively level areas where minimal vegetation clearing would be required. Staging area dimensions typically would be 200.0 x 200.0 ft (60.1 x 60.1 m) These areas would not be graded.

Trees within and adjacent to the ROW would be removed to provide clearance for conductors; vegetation clearing would probably not be necessary. No blading would be necessary.

The transmission line would be supported by wooden H-frame poles placed at approximately 800.0-ft (243.8-m) intervals along the ROW. Between 194 and 234 structures would be required, depending on the route selected. Structure holes would be approximately 3.0 ft (0.9 m) in diameter and 10.0 ft (3.0 m) deep and would be drilled or augered wherever feasible. In areas where consolidated rock could not be avoided, structure holes would be opened using dynamite. All blasting would be conducted by a permitted contractor and would be in compliance with state and federal regulations. Structures would be assembled on-site. Aboveground pole height would range from 70.0 to 100.0 ft (21.3 to 30.5 m). Disturbance at each structure location would average 50.0 x 100.0 ft (15.2 x 30.5 m) (0.1 ac). Structure erection and conductor stringing would occur sequentially along the ROW. Overhead wires would consist of three nonspecular (low reflectivity) conductors and two continuous ground wires. Ground wires would be marked with balls or other devices to improve visibility to birds where the transmission line crosses the Medicine Bow River and Foote Creek.

Existing public and private roads would be used to transport materials and equipment from the storage yards to ingress points along the ROW. The ROW (and existing roads, where feasible) would be used to access staging and structure assembly areas. Temporary use permits to access the ROW from public roads would be obtained from the BLM; landowner permission would be obtained prior to using private roads.

Final cleanup and restoration would occur immediately following construction. Waste materials (e.g., brush, rock, construction materials) would be removed from the area and recycled or disposed of at approved facilities. Excess dirt would be tamped around poles or spread on the ROW. Revegetation of scalped or cleared areas would occur in the first fall following construction. Barriers may be placed where the ROW intersects roads to prevent unauthorized traffic on the ROW, if required by BLM.

2.1.4.6 Final Testing

Final testing would involve both mechanical, electrical, and communications inspections to ensure that all systems are working properly. Performance testing would be conducted by qualified windpower technicians and would include checks of each wind turbine and the control system prior to final turbine tower and meteorological tower commissioning. Electrical tests of the Windplant (i.e., turbines, transformers, and distribution systems) and transmission systems (i.e., transmission lines and substations) would be performed by qualified electricians to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications. All installations and inspections would be in compliance with applicable codes and standards (Table 2.4). Details of testing procedures are proprietary and will not be included in this EIS.

2.1.4.7 Final Road Grading, Erosion Control, and Site Clean-up

Erosion control procedures would comply with BLM and WDEQ standards and would include sediment control basins and traps in drainages or other erosion control devices (e.g., jute netting, soil stabilizers, check dams) to minimize soil erosion during and after construction. Surface flows would be directed away from cut-and-fill

Table 2.4 Applicable Electrical Codes, Standards, and References.

- National Electrical Safety Code (NESC)
- National Electrical Manufacturer's Association (NEMA)
- American Society for Testing and Materials (ASTM)
- Institute of Electrical and Electronic Engineers (IEEE)
- National Electrical Testing Association (NETA)
- American National Standards Institute (ANSI)
- State and Local Codes and Ordinances
- Insulated Power Cables Engineers Association (IPCEA)
- Occupational Safety and Health Act (OSHA) Part 1910; Subpart S, 1910.308

slopes and into ditches which outlet to natural drainages. KENETECH would rent dumpsters from a local sanitation company to collect and dispose of waste materials. Cleanup crews would patrol construction sites on a regular basis to remove litter. A final site cleanup would be made prior to shifting responsibilities to O&M crews. O&M crews would continue to use dumpsters for daily maintenance.

2.1.5 Public Access and Safety

Public access to the federal and state lands would not be restricted, except in the immediate vicinity of the wind turbines and facilities. If fencing is used, only the base of each turbine would be fenced. Windplant and Miner's substations would be fenced (see Section 2.1.3.2) to prevent public and wildlife access to high voltage equipment.

No lighting of the towers or other facilities, except the substations, is anticipated. The Federal Aviation Administration generally does not require lighting on towers less than 200.0 ft (61 m) tall unless they are in the vicinity of an airport (49 C.F.R. Part 77). The project site is not in the vicinity of any airport.

All of the project area is within a full fire suppression area (i.e., wildfires are extinguished as soon as possible) (BLM 1987:72). Because O&M personnel are on-site during daylight working hours and in frequent communication with central operations, any fires seen would be noted immediately and reported to local authorities. Some fire-fighting equipment would be located in the O&M buildings and vehicles. Fire deterrents within the Windplant would include access roads, which may serve as fire breaks, and regular clearing of vegetation from areas around transformers, riser poles, and buildings.

Safety signing would be posted around all towers where necessary, transformers, and other high voltage facilities, and along roads, in conformance with applicable state and federal regulations.

KENETECH has demonstrated to BLM that it is committed to the safety of all employees, contractors, and visitors to the Windplant and has developed a safety policy and a detailed set of guidelines for safety within the Windplant (U.S. Windpower 1989). The policy identifies the chain of command for enforcing guidelines, the actions to be taken to correct unsafe or potentially unsafe conditions, and the penalties for safety violations.

2.1.6 Operations and Maintenance

KENETECH would operate and maintain the Windplant under an O&M Agreement with the Windplant owners. The scope of the agreement would include general maintenance services, O&M services, and replacement parts for major components of the wind turbines. All turbines, collection and communications lines, substations, and transmission lines would be operated in a safe manner according to standard industry operating procedures. Routine maintenance of the turbines would be necessary to maximize performance and detect potential difficulties. Each turbine would be remotely scanned by computer every day to ensure operations are proceeding efficiently. Any problems would be promptly reported to on-site O&M personnel (Windsmiths). Windsmiths would perform both routine maintenance and most major repairs. Most servicing would be performed "uptower", (i.e., without using a crane to remove the turbine from the tower). Additionally, all roads, pads, and trenched areas would be regularly inspected and maintained to minimize erosion.

2.1.7 Work Force

Approximately 126 people per day would be required during construction of the first phase of development (Table 2.5). Most construction work would probably be completed during the second (April-June) and third (July-September) quarters within a given year, and the employment estimates assume that construction would be completed in six months. Some construction work during the first and fourth quarters may be necessary for one or more phases of development, but most construction would occur during second and third quarters. Additional phases would be constructed in 50 to 100-MW increments and would employ 86 to 172 personnel, respectively (Section 3.4). Operations and maintenance would require up to nine Windsmiths for the first phase of development, and an additional 20 Windsmiths to operate and maintain the full 500-MW Windplant.

It is anticipated that approximately 20 people per day would be required for transmission line structure assembly and erection and conductor stringing (Table 2.6). These tasks would be completed in approximately 50 days during the second and third quarters of 1995 (April-September). Windplant substation construction would require approximately 10 people for approximately 120 days during the second and third quarters of 1995, and the additions to Miner's substation would require about five people for about the same 120 days. Reclamation would require three people for approximately 20 days during the third or fourth quarters in 1995. The transmission line would be routinely inspected by one person about two times per year.

2.1.8 Traffic

Construction of Windplant roads, facilities, and collection and communications lines would occur simultaneously, utilizing single vehicles for multiple tasks. The average number of daily vehicle trips to the site would range from 30 to 70 (depending on the size of the phase being constructed), while the average number of vehicles actually working on-site would be 15 to 40 (Table 2.7). During normal O&M, daily traffic to and on the site would include three 4-wheel drive pickups for the first phase of development. Approximately 15 to 20 pickups would be needed for daily O&M of the full 500-MW Windplant. Section 3.4, Socioeconomics, describes communities from which traffic to the KPPA would originate. Snow removal equipment (typically trucks equipped with wing-style blades) would be utilized as needed during winter (approximately November through May).

Transmission line construction would require four to six round trips per day during structure assembly and erection and conductor stringing (Table 2.8). Substation construction would require approximately four round trips per day for both the Windplant and Miner's substations. Approximately one round trip per day would be needed during reclamation, and O&M would require about two trips per year.

Table 2.5 Estimated Employment Requirements, Windplant Construction.[1]

Labor Category	Estimated 70.5-MW Phase I	Estimated 50-MW Any Phase	Estimated 100-MW Any Phase
Carpenter/form setter	7	5	10
Cement finisher	2	1	2
Cement, rebar	3	2	5
Electrician helper	18	12	22
Electrician, industrial	12	8	16
Electrician, master	2	1	2
Laborer	42	30	60
Structural steel worker	18	12	25
Backhoe operator	3	2	5
Cherry picker operator	8	6	12
Cable crane operator	5	4	7
Dozer operator	2	1	2
Power shovel operator	2	1	2
Road roller operator	2	1	2
Estimated daily total	126	86	172

[1] Estimated daily average employment for the 2nd (April-June) and 3rd (July-September) quarters; assumes construction would be completed in six months.

Table 2.6 Estimated Employment Requirements, Transmission Line Construction.

Employment Activity	Number of Personnel in Each Crew	Number of Simultaneously Active Crews	Total Number of Individuals	Total Number of Person-days	Quarter
Structure assembly and erection (50 days)	1 foreman 2 linemen 1 equipment operator 1 laborer	4	20	1,000	2nd (April-June)
Conductor stringing (50 days)	1 foreman 2 linemen 1 equipment operator 1 laborer	4	20	1,000	3rd (July-September)
Windplant substation construction (120 days)	1 foreman 3 wiremen 1 equipment operator	2	10	1,200	2nd and 3rd (April-September)
Miner's substation additions (120 days)	1 foreman 3 wiremen 1 equipment operator	1	5	600	2nd and 3rd (April-September)
Reclamation (20 days)	1 equipment operator	3	3	60	3rd or 4th (September or October)
O&M (LOP) (2 days/year)	1 lineman	1	1	2/year	Year-round

Table 2.7 Estimated Windplant Construction Traffic.

Type of Traffic	70.5-MW Phase	50-MW Phase	100-MW Phase
Construction workers to site	50-125[1]	35-85[1]	70-170[1]
Construction vehicles to site	40-50[1]	30-35[1]	60-70[1]
Construction vehicles on site	25-30	15-20	30-40

[1] Number of trips per day.

Table 2.8 Estimated Traffic Requirements, Transmission Line Construction.

Type of Traffic	Round Trips/Day	Total Round Trips (LOP)
Structure assembly and erection (50 days)	6	300
Conductor stringing (50 days)	4	200
Windplant substation construction (120 days)	4	480
Miner's substation additions (120 days)	4	480
Reclamation (20 days)	1	20
O&M (LOP)	2/year	2/year

2.1.9 Hazardous Materials

As mandated under BLM Instruction Memoranda Nos. WO-93-344 and WY-94-059, all NEPA documents must list and describe any hazardous or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. Hazardous materials are those chemicals listed in the EPA's *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Re-authorization Act (SARA) of 1986*; extremely hazardous materials are those defined in 40 C.F.R. 355. Hazardous materials anticipated to be used or produced during the implementation of this Proposed Action fall into the following categories:

- fuels - gasoline (potentially containing benzenes, toluene, xylenes, methyl-tert-butyl ether, and tetraethyl lead), and diesel fuel;
- combustion emissions - nitrogen oxides (NO_x), carbon monoxide (CO), and non-methane hydrocarbons (NMHCs);
- lubricants - grease (potentially containing complex hydrocarbons and lithium compounds) and motor oil;
- transmission line emissions - ozone and NO_x; and
- wood preservative for power line poles.

The 33M-VS uses three lubricating oils and greases: Mobil SHC 632, Mobil DTE 13M, and Chevron EP 15046; only one of these, Mobil DTE 13M, contains any compounds listed as hazardous by EPA. These are used in moderate quantities [<64 gallons (gal) (242.3 liters [l]) per turbine] and are contained entirely within the spill trap and nacelle so that the possibility for accidental leakage is minimal. Lubricating oils and greases would be checked semiannually, filled as needed, and changed once a year. Spent fluids would be recycled via a certified waste contractor. The oil change would be performed uptower, where any accidental spills would be contained by the nacelle. Construction equipment and O&M trucks would be properly maintained at all times to minimize leaks of motor oils, hydraulic fluids, and fuels. All vehicular maintenance would be performed off-site at an appropriate facility. One cleaning compound, Green-sol, or another similar environmentally benign detergent, would be used to remove wind-carried particulate matter from internal turbine mechanisms. The wooden structures used for Windplant power lines and the 230-kV transmission line would be treated with pentachlorophenol wood preserver; pentachlorophenol is listed as hazardous by the EPA.

The padmount transformers used in the Windplant contain 10c transformer insulating oil. The larger 1250-average kV padmount transformer (serving three turbines) contains about 500 gal of the oil; the smaller 750-average kV transformers contain approximately 300 gal of the oil. The 70.5-MW Phase I would require about 34,200 gal of transformer oil. The completed first 200 MW would require about 97,750 gal of transformer oil, and the completed 500-MW Windplant would require approximately 236,300 gal. All of the transformers store the oil in completely sealed containers.

Further, specific information regarding the types and quantities of hazardous materials, as well as their production, use, storage, transport, and disposal for the proposed project, would be provided in the Hazardous Materials Management Plan (HMMP) for the proposed project. This plan will be presented as an appendix to the Final EIS (FEIS) for this project, and will be available upon request from the BLM GDRA and Rawlins District Offices in early 1995. No extremely hazardous materials (40 C.F.R. 355) are presently anticipated to be produced, used, stored, transported, or disposed of as a result of the proposed project.

All production, use, storage, transport, and disposal of hazardous materials as a result of this project would be in strict accordance with federal, state, and local government regulations and guidelines. Notice of any spill or leakage (i.e., undesirable event), would be immediately given by KENETECH to the AO and other such federal and state officials as required by law. Any oral notice

would be confirmed in writing within 72 hours (hr) of any such occurrence.

2.1.10 Reclamation and Abandonment

Reclamation would be conducted on all disturbed areas to comply with the BLM Wyoming Policy on Reclamation (BLM 1990a). The short-term goal of reclamation would be to stabilize disturbed areas as rapidly as possible, thereby protecting sites and adjacent undisturbed areas from degradation. The long-term goal would be to return the land to approximate pre-disturbance conditions.

All Windplant facilities would be operational for the LOP, and thus, only minor post-construction reclamation would take place. Reclamation specifications, including methods, seed mixtures, erosion control measures, etc., would be developed by KENETECH and PacifiCorp in consultation with the BLM or other surface owners. After construction is complete, temporary work areas would be graded to the approximate original contour, and the area would be revegetated with an approved mixture of native species. Most of the post-construction work would entail stabilizing slopes and reseeding unused disturbed areas including tower pads, road cut-and-fills, underground cable trenches, overhead collection line routes, and the transmission line route. Approximately 78% of the new disturbance acres would be revegetated after Phase I construction is completed [Table 2.1(a)], 60% of all disturbance from construction of the 500-MW Windplant would be reclaimed upon construction completion.

While the ROW grant would have a 30-year term, it could be renewed indefinitely, and thus, the anticipated life of the Windplant is greater than 30 years. Assuming that there is future demand (after the 30-year term) for the electricity generated by the Windplant, old or worn facilities would be replaced with new or upgraded facilities, and technological advances would be incorporated into the Windplant. Therefore, the estimated life of the plant depends primarily on the demand for power, which is expected to continue growing (see Chapter 1.0). Similarly, the 230-kV transmission line would provide the linkage between the Windplant and the power grid for the life of the Windplant.

At the end of the project's useful life, KENETECH and PacifiCorp would obtain any necessary authorization from the appropriate regulatory agency or landowner to abandon the facilities. Upon abandonment, all facilities would be removed to a depth of 6 inches below grade, and unsalvageable material would be disposed of at authorized sites. Assuming that the transmission line would not be used for other developments, all structures, conductors, and cables also would be removed. Reclamation procedures would be based on site-specific requirements and techniques commonly employed at the time the area is to be reclaimed, and would include regrading, topsoiling, and revegetation of all disturbed areas. Abandoned ROWs would be reclaimed or left in place based on agency or landowner preference. The ROWs then would revert to agency or landowner control.

2.1.11 Project-wide Mitigation Measures

KENETECH and PacifiCorp propose to implement the following project-wide mitigation measures to avoid, reduce, or eliminate project impacts. Project-wide mitigation measures may be waived on a case-by-case basis when deemed appropriate by the BLM after thorough analysis determines that the resource for which the measure was put in place would not be significantly impacted.

Windplant impacts on wildlife are the subject of continuing study for this project. Because wildlife impacts are not completely understood at this time, monitoring will be an integral part of the mitigation program for wildlife.

KENETECH has sponsored extensive research on the effects of Windplants on avian wildlife. The research is being conducted through the World Center for Birds of Prey, the Peregrine Fund, Raptor Research and Technical Assistance Center,

and several universities, by a group of experts in the fields of bird behavior and physiology. As part of the research, the task force has been examining the effects of various technological designs on bird behavior around wind turbines. The objective of these studies is to identify ways to vary turbine design and placement to reduce avian mortality. The avian task force has identified four critical steps toward minimizing avian collisions within Windplants:

- Initial plans for siting Windplants should take into consideration the entire annual cycle and pattern of avian use of the proposed project area. By the time the FEIS for this project is released, BLM will have one complete year of avian use data for the Foote Creek Rim area which will be used to evaluate siting options for the first few phases of development.
- The size and physical configuration of the Windplant, turbine spacing, locations of turbine corridors, etc., should be evaluated with respect to the kinds of birds and their activities in the area. Using data collected from the project area between 1993 and 1995, high use areas and known nesting areas will be identified and avoided, as much as possible, during siting of the first few phases.
- Turbines and towers should be designed to reduce collisions by reducing perching opportunities, and turbine rotors should be patterned to maximize their visibility to birds under a wide range of conditions. The Proposed Action would entail use of modified tubular towers, and all power line structures within the Windplant would be equipped with antiperching devices, thereby minimizing the number of new perches in the KPPA. The task force is currently investigating other design features (e.g., painting patterns on rotors) to improve rotor visibility. Other investigations being conducted by the task force are discussed in Section 5.1.3.10; a complete summary report is available from the BLM.
- Off-site mitigation should be evaluated to help compensate for unpreventable mortalities. Off-site mitigation has not yet been considered because mortality rates are not yet known (Section 4.2.3).

In addition to the studies being conducted by the avian task force, baseline data collection studies of avian use of the Foote Creek Rim and Simpson Ridge areas are being conducted. The studies include passerine and raptor inventories to assess relative use, raptor nesting surveys, and sage grouse lek surveys. Data collection and analysis methods are included in Appendix A.

Mortality rates will be measured during monitoring (Appendix B) beginning with the first phase of development, and monitoring results will be provided to cooperating agencies and to the public, upon request. During monitoring, site-specific information on avian and other wildlife interactions with the Windplant would be collected and analyzed, impacts would be identified, and appropriate site-specific mitigation measures would be incorporated into the POD for subsequent phases. Monitoring and mitigation would be an ongoing process, with data from prior phases influencing the design and placement of subsequent phases.

Modifications to turbine/tower design features would be made based on monitoring data from the first phases of development. Retrofit of prior phases would not include replacement of capital items (e.g., rotors, towers, nacelles), but could include removing the rotor from turbines associated with high mortality rates, painting turbine rotors, or other measures not requiring capital expenditure.

Other project-wide mitigation measures are listed below and in Chapter 5.0.

1) Mitigation measures would be adhered to on federal and state lands, and on private lands, subject to landowner preferences.

2) Windplant facilities (e.g., turbine towers, roads, power lines) would be placed to minimize or avoid disturbance in areas with high value wildlife habitat (e.g., crucial winter range, wetlands, and riparian areas).

3) Areas with high erosion potential and/or rugged topography (i.e., steep slopes, dunes, floodplains, unstable soils) would be avoided, where feasible. If disturbance in these areas is necessary, stringent erosion control and soil stabilization measures would be implemented immediately.

4) Surface disturbance or occupancy would not occur on slopes in excess of 25%, where feasible, nor would construction occur when soils are wet or frozen, whenever feasible.

5) Removal or disturbance of vegetation would be kept to a minimum through construction site management (e.g., utilizing previously disturbed areas, using existing ROWs, designating limited equipment/materials storage yards and staging areas, scalping, etc.).

6) Topsoil would be salvaged prior to construction to facilitate revegetation. After construction, all salvaged topsoil would be spread evenly over all surfaces to be revegetated and seeded. All seeding would use an approved mixture of native and/or introduced species. Because of the extended LOP, no topsoil would be stockpiled beyond completion of post-construction reclamation.

7) Revegetation methods would include:
   a) deep ripping of compacted soil prior to reseeding, where necessary;
   b) broadcast or drill seeding, depending on site conditions;
   c) fall seeding (September 15 to freeze-up), where feasible;
   d) spring reseeding (after the ground thaws and prior to April 15) if fall seeding is not feasible;
   e) utilization of native cool season grasses, forbs, and shrubs in a mixture specified by KENETECH and PacifiCorp and approved by the landowner or BLM;
   f) addition of BLM-approved introduced species (e.g., crested wheatgrass, Russian wildrye) to the seed mixture if attempts at revegetation with native species are unsuccessful;
   g) installation of waterbars on disturbed slopes with grades of 6% or greater to reduce erosion (waterbars may be installed on disturbed slopes with grades less than 6% in areas with unstable soils); and
   h) possible fencing of sensitive reclamation sites.

8) Vegetation and soil removal would be accomplished in a manner that would prevent erosion and sedimentation.

9) Construction would be avoided within 500.0 ft (152.4 m) of surface water or wetland areas where feasible. Where wetlands, riparian areas, or ephemeral stream channels must be disturbed, the following measures would be employed:
   a) Wetland areas would be crossed during dry conditions (i.e., late summer, fall, or dry winters).
   b) Streambeds would be crossed perpendicular to flow, where feasible.
   c) Streams, wetlands, and riparian areas disturbed during project construction would be restored to pre-project conditions. If impermeable soils contributed to wetland formation, soils would be compacted to restore impermeability.
   d) Recontouring and appropriate/adapted species would be used to revegetate the banks to aid in soil stabilization.

e) Revegetation operations would begin on impacted areas immediately after completion of project construction activities.

10) Intermittent and ephemeral drainages would be protected from surface disturbance within 75.0 ft (22.9 m) of the channel or the inner gorge, whichever is closer, where feasible.

11) Temporary erosion control measures such as mulch, jute netting, sediment traps, or other appropriate methods would be used on unstable soils, steep slopes, and wetland areas to prevent erosion and sedimentation until vegetation becomes established.

12) 230-kV transmission line structures would be located at least 40.0 ft (12.2 m) from pipelines, and conductors would be at least 30.0 ft (9.1 m) above ground level at all pipeline and road crossings. Structures would be located at least 100.0 ft (30.5 m) from all streams. Stream crossings would be avoided during materials-hauling and structure-assembly and erection by using existing roads to access the ROW, where feasible. Where conductors must be strung across perennial streams, ropes would be used to haul the conductors across the stream. Intermittent or ephemeral channels would be crossed during periods of no flow.

13) Surface disturbance within 0.75 mi (1.2 km) of active raptor nest sites (i.e., used within the last three years) would be avoided during the nesting season (February 1 through July 31). If the area must be impacted, project activities would occur outside the nesting season. Extensive raptor nesting studies are being completed as part of the baseline avifauna studies (Appendix A) and would continue as part of the monitoring program for the project (Appendix B).

14) Windplant facilities would be designed or equipped to prevent raptor perching (e.g., using tubular rather than lattice towers, equipping turbine nacelles and power poles within the Windplant with antiperching devices).

15) Poles for collection and transmission lines located within 0.25 mi (0.4 km) of sage grouse leks would be equipped with raptor antiperching devices to minimize the opportunities for raptors to prey on sage grouse. Poles located near prairie dog colonies within the black-footed ferret (BFF) Primary Management Zone (PMZ) also would be equipped with raptor antiperching devices to minimize the take of prairie dogs or the potential take of BFFs by birds of prey.

16) To protect important big game winter habitat, activities or surface use would not be allowed from November 15 to April 30 within certain areas encompassed by the ROW grant. The same criterion would apply to defined big game birthing areas from May 1 to June 30.

17) Known active sage grouse leks and adjacent public land areas [2.0 mi (3.2 km) radius from lek centers] would be avoided during the breeding and nesting seasons from March 1 through June 30. No construction activities would be conducted on public lands within 0.25 mi (0.4 km) of known nest sites; and project activities, other than those required for O&M along existing roads within 0.25 mi (0.4 km) would be curtailed during the period from 1 hr before

daylight to 9:00 a.m. from March 1 through April 30.

18) Substations and other areas that would be hazardous to wildlife would be fenced as directed by the BLM.

19) Paleontological and archaeological surveys would be completed prior to disturbance, with monitoring as necessary during disturbance of impacted areas with high resource potential. Paleontological or cultural resource sites would be avoided or mitigated, as necessary, prior to disturbance. Any cultural or paleontological resource discovered by the operator or any person working on his or her behalf would be immediately reported to the BLM. All construction operations within 50.0 ft (15.2 m) of such a discovery would be suspended as required by BLM regulations until written authorization to proceed is issued by the AO. An evaluation of the discovery would be made by the AO to determine appropriate actions to prevent the loss of significant cultural or scientific values.

20) Approval from the BLM AO, in consultation with other agency personnel (e.g., WGFD, USFWS), would be required prior to construction in areas (e.g., crucial water ranges, near raptor nests) where federal regulations are applied to protect sensitive resources (e.g., wildlife). This action would allow project activities to proceed in restricted areas and/or during periods of restriction (e.g., mild winters, abandoned raptor nest sites, etc.), if deemed appropriate.

21) KENETECH would continue to work with BLM and Native American tribes on mitigative measures for cultural resources through each phase of the project.

22) All livestock control fences would conform to BLM Manual Handbook H-1741-1 for the passage of wildlife.

2.2 ALTERNATIVE A

Under Alternative A, the BLM would issue a ROW grant to construct a 300-MW Windplant on public lands in the project area. The Windplant would consist of approximately 835 WTGs and the associated facilities described for the Proposed Action, including the 230-kV transmission line to the Miner's substation to connect the Windplant to the western U.S. power grid.

All facilities would be the same as described for the Proposed Action except that there would be 40% fewer towers, turbines, and transformers; and fewer miles of access roads, underground and overhead collection lines, and communications cables. Turbine densities would be lower in portions of the KPPA, depending on the arrangement of turbine arrays. Some facilities (i.e., the 230-kV transmission line and O&M and communications buildings) would be identical in size and number regardless of the alternative selected. Table 2.1 presents a comparison of the facilities requirements and the amount of disturbance for the Proposed Action compared with Alternative A.

Under Alternative A, the project also would be developed in phases, beginning with the 70.5-MW (201 WTGs) phase on Foote Creek Rim, as described for the Proposed Action. The 300-MW Windplant would be built in 50 to 100-MW phases until total Windplant size reached 300 MW. Therefore, the complete Windplant could be developed in approximately three to six years, compared with 10 to 12 years for the 500-MW Windplant. A POD would be prepared and an NTP issued prior to construction of each phase.

2.3 NO ACTION ALTERNATIVE

For the KENETECH Windpower project, the No Action Alternative would deny issuance of a ROW grant to construct a Windplant on public land within the project area, including the turbines, towers, and ancillary facilities. In the absence of a Windplant, there would be no need for PacifiCorp to construct the proposed 230-kV transmission line.

The No Action Alternative is not expected to result in direct development of another energy source within the KPPA, the GDRA, or the area serviced by BPA, PacifiCorp, Tri-state, PSCo, or EWEB. Some of these suppliers currently have a surplus of electric power generating capacity (e.g., BPA). Over the long term, however, demands for base load and peak load electric power are increasing (Chapter 1.0), and utilities throughout the western U.S. are seeking additional resources to help meet future demands. The No Action Alternative would add incrementally to the probable future power deficit, but because the proposed Windplant would contribute only a small amount of power to each supplier, it is not likely to cause BPA or any utility to immediately build a new power plant.

2.4 ALTERNATIVES CONSIDERED BUT REJECTED

Four other alternatives were considered but rejected because they did not meet the purpose and need or were not reasonably feasible. These will not be discussed in detail in this EIS.

Alternate Project Location. Under this alternative, an alternate location for the project would be selected (i.e., in Wyoming or in the region) and analyzed. Selecting an alternate site within the region was rejected because it would not satisfy the purpose and need for the project (i.e., to construct a demonstration and production Windplant in Wyoming). The following discussion provides a rationale for rejecting alternate sites in Wyoming.

Because average windspeed for any site may include winds that are above the operating capacity of WTGs, comparing average windspeeds among different sites may not accurately reflect the potential power output from various sites. For example, a site having frequent high or gusty winds would have a high average windspeed, but the overall power output would be lower than a site having lower average windspeeds, but more persistent winds. The cost per kWh of wind-generated electricity is proportional to the available power output of the wind resource at the generation site.

With the appropriate meteorological data, power output can be estimated and used to compare generating potential among different sites. Expected power output data from Wyoming sites for which extensive wind data are available show that the Foote Creek Rim area would have 25-73% greater power output than other sites (Table 2.9). The estimated power output from the Simpson Ridge area is about 90% of the estimated output from the Foote Creek Rim area. These two sites would enable more cost-effective power generation, and thus, lower kWh costs for the utility, and ultimately, the consumer. Cost comparisons of various alternate sites show that whereas the cost of wind energy from the Foote Creek Rim area would be about 3.2 cents per kWh (not including wheeling costs), costs from other sites would range from 4.0-10.6 cents per kWh (i.e., 24%-231% higher costs) (Table 2.9).

Most state public utility commissions, including the Wyoming Public Service Commission, either encourage or require utilities to utilize "Least Cost Integrated Resource Planning", a tool that requires that all resource alternatives available to a utility are evaluated for potential inclusion in the utility's resource portfolio on the basis of cost-effectiveness. With the current state of technology, wind energy is cost-effective only at sites with persistent high winds. New fossil fuel-fired electricity generation costs between 3.0 and 5.0 cents per kWh. Under the wind regimes in the Foote Creek Rim and Simpson Ridge areas, the cost per kWh would be an estimated 3.2 to

Table 2.9 Estimated Power Output from Potential Alternative Sites in Wyoming.

	Estimated Power Output (% of Estimated Power Output from Foote Creek Rim Area 70.5-MW, Phase I)	Cost Penalty of Less Energetic Sites[1]	Annual Cost Penalty of Power from Alternative Site vs. Foote Creek Rim Area 70.5-MW, Phase I[2]
Foote Creek Rim	100	0	0
Simpson Ridge	90	5	257,924
Chugwater	75	24	1,232,120
Kemmerer	75	24	1,232,120
Medicine Bow	73	25	1,314,261
Rock River South	65	38	1,971,392
Rock Springs	65	38	1,971,392
Rawlins	63	44	2,299,957
Coyote Springs	63	44	2,299,957
Bridger Butte	60-70	38	1,971,392
Rock River North	63	44	2,299,957
Medicine Bow SW	61	50	2,628,522
Medicine Bow SE	60	50	2,628,522
Wheatland Reservoir 1	60	50	2,628,522
Fish Hatchery	59	57	2,957,087
Medicine Bow Airport	55	63	3,285,653
Wheatland Reservoir 2	52	72	3,778,500
Casper	50	70	4,107,066
Laramie	45	98	5,092,761
Cheyenne	44	101	5,257,044
Ferris	35	151	7,885,566
Buzzard Ranch	35	154	8,049,849
Red Desert	27	246	12,814,045

1 Kwh costs take into account varying transmission line costs for alternative sites.

2 All costs are in 1994 dollars, and omit wheeling costs. Projections include 1.5-cent Production Tax Credit, and are based on a typical investor-owned utility cost of financing.

3.6 cents per kWh (depending on turbine location and not including transmission costs) (KENETECH 1994).

Utility company acceptance of wind energy in this region of the U.S. is extremely sensitive to kWh cost. The Pacific Northwest has electric rates which are 40% below the national average (Begley et al. 1994). Even a few mills of higher cost could render the project uneconomical for utility companies, particularly when compared to natural gas combustion turbines, which have costs close to 3.0 cents per kWh. KENETECH has contractual obligations with utility companies to provide windpower at a certain rate; choosing a less energetic site could effectively terminate the project.

KENETECH analyzed and rejected various alternative sites in Wyoming based on the wind-resource/cost relationships described above. One other site within the wind corridor, Dana Ridge, would have been a suitable site for the proposed project. However, that site was rejected after consultation with the WGFD in August 1992, which indicated that the Dana Ridge contained an important mule deer migration corridor. During the 1992 consultations, WGFD indicated that the Simpson Ridge and Foote Creek Rim areas were free of known big game migration corridors or crucial winter range, although detailed studies of migration and use have not been conducted within these areas. Based on this initial clearance by WGFD, these areas were selected for the proposed project. Subsequent to the 1992 consultations, at the request of the BLM, the Simpson Ridge area was expanded to its present configuration to allow more opportunities to avoid development in the Hanna RCA. Approximately 3,841 ac of pronghorn crucial winter/yearlong ranges were incorporated into the proposed project area during the expansion (Section 4.2.3), but the new area was incorporated with the knowledge that standard BLM stipulations regulating construction within crucial winter range during critical winter periods would be implemented to mitigate impacts on pronghorn.

<u>Expand or Reduce the Project Area Size</u>. Expanding the project area would allow greater flexibility for selecting development locations that minimize environmental impacts. However, since the project area is already large enough that facilities would not be built in sensitive areas and would be located to minimize impacts within the project area, an alternative with a larger project area would not increase the environmental protection available under the Proposed Action. A smaller area would only reduce the number of suitable sites for development such that potential impacts could be greater than for the Proposed Action, and therefore, this is not an environmentally preferred alternative.

<u>Construct the Project in One Phase</u>. Under this alternative, the entire project would be built in one phase, and only one POD would be prepared. There were two reasons for rejecting this alternative. First, KENETECH has not yet contracted to sell the full 500 MW of power. Second, the opportunity to monitor impacts from early phases and improve Windplant design in subsequent phases would be lost.

<u>Alternative Energy Sources</u>. Under this alternative, the impacts of generating the 500 MW of power via coal, oil, gas, solar, or hydropower would be compared with the Proposed Action. A discussion of the positive and negative impacts of alternative energy resources is out of the scope of this document. Other environmental documents [e.g., the BPA Resource Programs EIS (BPA 1993), the Western Energy Planning and Management Program Draft EIS (WESTERN 1994)] provide discussions of the costs and benefits of various electric power-generating resources. The concept that is widely used to evaluate energy costs is that all energy sources have environmental externalities (i.e., environmental costs associated with power generation that are borne by society without compensation). These externalities have also been called environmental costs or environmental damages. Environmental externalities include, for example, the costs of health effects caused by air pollution, habitat mitigation due to damage by acid

rain, controlling emissions, or protecting Pacific Northwest salmon.

Some utilities are incorporating costs for externalities into their resource programs and using a variety of approaches for assessing these often intangible costs (Baechler and Lee 1991; Putta 1990; Buchanan 1990; Ottinger et al. 1990; WESTERN 1994). Table 2.10 presents estimated costs for externalities for selected electric power-generating resources and shows that known externalities associated with windpower are lower than all other major resources. As the environmental consequences of windpower are further studied, costs for externalities will likely change. The alternative of other energy sources was rejected because the purpose of the project is to develop a wind energy source in Wyoming to help meet the western region's growing demand for energy and (for the 25-MW portion) to demonstrate the feasibility of wind-generated power.

Other possible alternatives, including turbine design changes or alternate placement of turbines within the project area, have been incorporated into the Proposed Action and Alternative A.

2.5 SUMMARY OF ENVIRONMENTAL IMPACTS

A summary of impacts for the Proposed Action, Alternative A, and the No Action Alternative is presented in Table 2.11. Detailed discussions of the environmental impacts and mitigation measures of the proposed project and alternatives are presented in Chapters 4.0 and 5.0, respectively.

Table 2.10 A Comparison of Externality Costs that Would Be Added to Other Resource Costs for the Competitive Acquisition of Firm Energy (1990 mills/kWh)[1].

Resource Type	BPA	Calif.	Mass.	Nevada	New York	Ottinger et al. (1990)[2]
Pulverized coal	5.1	83.1	46.5	45.4	9.1	39
Atmospheric fluidized bed coal	3.0	29.3	28.9	27.8	3.3	28
Coal gasification	2.5	21.0	25.7	27	2.5	25
Simple cycle combustion turbine	1.5	28	22.4	21.8	3.4	--
Combined cycle combustion turbine	1.4	16.5	19	15	2.3	10
New hydroelectric	2.0	--	--	--	--	--
Natural gas cogeneration	1.2	10.8	9.8	9.5	1.5	--
Existing hydroelectric additions	1.0	--	--	--	--	--
Geothermal	1.0	--	--	--	--	--
Wind	0.5	--	--	--	--	0-1
Solar	1.0	--	--	--	--	0-4
Conservation	0	--	--	--	--	--
Wood-fired cogeneration	3.8	61.4	16.5	16.5	6.1	0-7
Fired cogeneration	7.9	127	26.3	26.3	9.9	--
Nuclear	2.0	--	--	--	--	29

1 WESTERN (1994).
2 Costs for this column only are in 1989 mills/kWh.
-- No data available.

Table 2.11 Summary of Impact Analysis for the Proposed Action, Alternative A, and No Action.

Impact by Environmental Resource	Post-mitigation Impacts			
	Proposed Action	Alternative A	No Action	Mitigation(s)
		CLIMATE AND AIR QUALITY		
Snow redistribution and subsequent impacts on wildlife, vegetation, soils, hydrology, and geologic hazards	Negligible to moderate - facilities could cause local changes in snow deposition patterns	Negligible to moderate; may be some reduction in impacts compared with Proposed Action, depending on facilities	No impact	Avoid fencing facilities where feasible; place downtower boxes within modified tubular towers where feasible; avoid snow accumulation areas.
Airborne particulates and emissions will increase but remain within state and federal standards	Negligible - small increases in dust and emissions adjacent to turbine locations, roads, and ancillary facilities; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Regularly maintain roads and equipment.
No additional pollutant emissions due to fossil fuel burning for electricity generation	Beneficial[1]; national or global scale; LOP and beyond	Beneficial; national or global scale; adverse and beneficial effects reduced by approximately 40% from Proposed Action	Electric power may be generated by a polluting resource; negligible; LOP	None.
		TOPOGRAPHY/PHYSIOGRAPHY		
Cuts and fills along turbine corridors, roads, substations, transmission line ROWs	Negligible - no major landscape alterations; site-specific; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid significant features.
Alteration of surface drainages	Negligible - no long-term modifications to drainages; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid drainages where feasible; reestablish and reclaim drainages; use appropriate road and culvert design; acquire 404 Permits as appropriate.
		MINERALS/GAS AND OIL		
Localized temporary loss of access to oil and gas reserves	Negligible-wind, oil, and gas development may be compatible	Negligible and reduced 40% from Proposed Action	Possible negative impacts on oil and gas reserves	Avoid potential future gas and oil development areas, if possible.
Localized temporary loss of access to mineral reserves	Negligible - no active coal or uranium mining; LOP	Negligible and reduced by approximately 40% from Proposed Action	Possible negative impact on coal reserves	Avoid gravel quarries and potential future coal and uranium mine sites, where feasible.

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts: Proposed Action	Alternative A	No Action	Mitigation(s)
GEOLOGIC HAZARDS				
Flood damage to facilities	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid floodplains and flood prone areas, where feasible.
Increased landslide potential due to snow accumulation	Negligible; LOP	Negligible; LOP	No impact	Locate facilities to avoid snow deposition on landslide prone areas, where feasible.
Reactivation of dunes due to ground cover removal	Negligible - no dunes and only a few windblown deposits in the KPPA; LOP	Negligible; LOP	No impact	Avoid windblown deposits where feasible; implement appropriate and timely reclamation, erosion control, and revegetation.
Earthquake damage to facilities	Negligible - very low earthquake potential; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Construct turbines and power lines to withstand moderate earthquakes.
Landslides and slumping at construction sites	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid unstable areas where feasible; implement appropriate and timely reclamation and erosion control.
Subsidence during or after construction	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid mined out areas, where feasible.
Subsidence, gas, and fires associated with abandoned coal mines	Negligible; site-specific; LOP	Negligible and reduced by approximately 40% from the Proposed Action	No impact	Avoid abandoned mine areas.
PALEONTOLOGICAL RESOURCES				
Disturbance/destruction of important fossils	Negligible during construction and LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid, recover, and/or monitor as determined during preconstruction BLM paleontological surveys; educate employees.
Loss of important fossil materials due to private collection or vandalism	Negligible during construction and LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid, recover, and/or monitor as determined during preconstruction BLM paleontological surveys; educate employees.
Discovery of previously unknown fossils	Beneficial during construction	Same as Proposed Action but reduced by approximately 40% from Proposed Action	Negligible - no new fossil discovery	None.

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts			
	Proposed Action	Alternative A	No Action	Mitigation(s)
		SOILS		
Disturbance and erosional loss of soils	Moderate during construction and negligible for the LOP; 1,787 ac initial disturbance and 715 ac new disturbance for LOP	Same as Proposed Action and reduced to 1,146 ac initial disturbance and 431 ac of new disturbance for LOP	No impact	Avoid erosion-prone areas where feasible; implement appropriate and timely use of erosion and sedimentation control techniques/devices; adhere to PODs.
Increased soil moisture due to snow accumulation	Beneficial - increased productivity; LOP	Beneficial; reduced from Proposed Action; LOP	No impact	None.
Increased erosion potential due to saturated soils in snow accumulation areas	Moderate on steeper slopes; LOP	Moderate on steeper slopes, reduced approximately 40% from Proposed Action; LOP	No impact	Avoid steep slopes and erosion-prone soils, where feasible; implement appropriate and timely use of erosion and sediment control techniques/devices; adhere to PODs.
Soil compaction and decreased productivity	Moderate during construction; negligible for the LOP	Reduced by approximately 40% from Proposed Action	No impact	Use appropriate reclamation techniques; restrict off-road vehicle travel.
Contamination due to accidental hazardous material spills	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Adhere to hazardous materials management and spill prevention and control countermeasure plans.
		SURFACE WATER RESOURCES		
Increased turbidity, salinity, and sedimentation of surface waters due to runoff from disturbed areas	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Use appropriate erosion and sedimentation control techniques/devices; adhere to PODs.
Contamination of surface waters from accidental hazardous material spills	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Adhere to hazardous materials management and spill prevention and control countermeasure plans.
Alteration of surface water runoff patterns due to snow redistribution	Negligible; LOP	Negligible and reduced from Proposed Action, depending on facilities placement	No impact	Avoid snow accumulation areas, where feasible.
		GROUNDWATER RESOURCES		
Contamination of groundwater from accidental hazardous material spills	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Adhere to hazardous materials management and spill prevention and control countermeasure plans.

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts			
	Proposed Action	Alternative A	No Action	Mitigation(s)
NOISE				
Increased noise levels near residences and within crucial wildlife habitats during critical periods	Moderate during construction; negligible for Phase I; possibly significant for the Foote Creek Rim 200-MW phase; probably negligible for future phases	Moderate during construction; negligible for the first phase; possibly significant for the Foote Creek Rim 200-MW phase; probably negligible for future phases; incidences reduced by approximately 40% from Proposed Action	No impact	Avoid residences; no construction activities within crucial wildlife habitats during critical periods; use equipment mufflers; insure regular maintenance of WTGs; avoid crucial and/or breeding and nesting habitats where feasible.
ODOR				
Presence of offensive odors proximal to facilities and roads	Negligible; LOP	Negligible and incidences reduced by approximately 40% from Proposed Action	No impact	Ensure regular equipment maintenance.
ELECTRIC AND MAGNETIC FIELDS				
Adverse human health effects	Negligible; LOP	Same as Proposed Action	No impact	None necessary.
Television (TV) or radio interference	Negligible; LOP	Same as Proposed Action	No impact	None necessary.
VEGETATION				
Removal of vegetation	Negligible - 1,787 ac initial disturbance and 715 ac for LOP	Negligible and reduced to 1,146 ac new initial disturbance and 431 ac new disturbance for LOP	No impact	Minimize number and size of disturbance areas; implement appropriate and timely reclamation, erosion control, and revegetation; adhere to PODs.
Changes in vegetation diversity following reclamation (i.e., shrubland to grassland) and potential weed infestation	Negligible - 1,787 ac initial disturbance and 715 ac for LOP	Negligible and reduced to 1,146 ac new initial disturbance and 431 ac new disturbance for LOP	No impact	Use appropriate weed control; restrict off-road vehicle travel; revegetate with native/approved species.
Disturbance of wetlands	Negligible - no net loss of wetlands; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid wetlands where feasible; obtain Army Corps of Engineers (COE) 404 Permits as necessary; adhere to PODs.
Reclamation unsuccessful after five years	Negligible to significant; LOP and beyond	Negligible to significant and reduced by approximately 40% from Proposed Action	No impact	Implement further BLM-approved reclamation efforts until successful revegetation achieved.
Changes in plant community composition due to snow redistribution	Negligible to potentially significant; LOP	Negligible to potentially significant, reduced depending on facilities placement; LOP	No impact	Avoid snow accumulation areas; use proper snow removal techniques.

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts			
	Proposed Action	Alternative A	No Action	Mitigation(s)
		VEGETATION (Continued)		
Wetland loss	Negligible; LOP	Negligible; LOP	No impact	Avoid wetlands, where feasible; mitigate all wetland disturbance.
Riparian area disturbance	Negligible; LOP	Negligible; LOP	No impact	Avoid riparian areas, where feasible; use best management practices during construction adjacent to riparian areas.
		WILDLIFE		
Loss of big game crucial habitat	Moderate; initial disturbance of 140 ac pronghorn crucial range and 42 ac mule deer crucial range	Moderate; initial disturbance of 106 ac pronghorn crucial range and 42 ac mule deer crucial range	No impact	Minimize project activities in these areas; implement appropriate reclamation with shrub species.
Big game displacement and/or stress	Negligible (white-tailed deer) to potentially significant (elk); variable responses noted in literature; LOP	Same as Proposed Action	No impact	Avoid construction and minimize other activities within crucial habitats during crucial periods.
Overall wildlife habitat (i.e., small mammals, amphibians, and reptiles) degradation	Negligible - 1,787 ac initial disturbance and 715 ac for LOP	Negligible and reduced to 1,146 ac new initial disturbance and 431 ac new disturbance for LOP	No impact	Use appropriate erosion control and reclamation techniques; appropriate monitoring, containment, and disposal of hazardous material.
Increased, nonavian wildlife mortality from activities of man	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Use appropriate road design; adhere to posted speed limits; educate employees; appropriately contain and dispose of hazardous material.
Avian mortality due to collisions with WTGs or power lines (legal implications)	Significant; LOP	Significant; LOP	No impact	Acquire federal and state permits for limited incidental take.
Declining raptor populations	Potentially significant; LOP	Possibly significant; reduced from Proposed Action depending on facilities placement	No impact	Design and place Windplant facilities to minimize avian mortality; use monitoring to improve designs to further mitigate impacts and to determine population trends.
Loss of sage grouse nesting habitat	Potentially significant; initial disturbance of 1,185 ac probable nesting habitat	Potentially significant; reduced to 754 ac new disturbance from Proposed Action	No impact	Minimize project activities in these areas; implement appropriate reclamation with shrub species.

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts: Proposed Action	Post-mitigation Impacts: Alternative A	Post-mitigation Impacts: No Action	Mitigation(s)
WILDLIFE (Continued)				
Declining nonraptor populations	Potentially significant for mountain plover and horned lark; probably negligible for other nonraptor species; LOP	Potentially significant for mountain plover and horned lark; probably negligible for other nonraptor species; LOP	No impact	Design and place Windplant facilities to minimize avian mortality; use monitoring to improve designs to further mitigate impacts and to determine population trends.
Degradation of surface waters resulting in fish population reductions	Negligible; LOP	Negligible; LOP	No impact	Avoid riparian areas and implement proper erosion control techniques.
THREATENED AND ENDANGERED SPECIES/STATE SENSITIVE SPECIES				
Mortality or disturbance of any listed or candidate T&E species or disturbance of critical habitat for listed and candidate T&E species	Significant- bald eagle, peregrine falcon, and ferruginous hawk known to use the area, mountain plover known to nest on Foote Creek Rim; negligible- no confirmed black-footed ferret sightings; no surface water withdrawal; LOP	Significant; LOP	No impact	Design and place Windplant facilities to minimize avian mortality; use monitoring to improve designs to further mitigate impacts; minimize habitat disturbance; avoid prairie dog colonies where feasible; implement black-footed ferret surveys as required; implement appropriate and timely reclamation and revegetation.
Reduction in state sensitive species due to mortality or habitat removal	Negligible; LOP	Negligible; LOP	No impact	Avoid habitats of potential occurrence, where feasible.
Destruction of TEC&S plant species or their habitat	Negligible; LOP	Negligible; LOP	No impact	Pre-disturbance surveys for TEC&S; avoidance of individuals or habitat, where feasible.
CULTURAL RESOURCES				
Disturbance/destruction of important sites	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Complete cultural surveys and data recovery as required.
Loss of important cultural materials due to private collection or vandalism	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Ensure employee education; disciplinary action as appropriate.
Disturbance of important Native American religious or culturally significant sites	Possibly significant for Phase I; unknown for future phases	Possibly significant for Phase I; unknown for future phases	No impact	Continue consultations with Native American groups to mitigate impacts. Complete Section 106 process prior to issuing FEIS.

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts			
	Proposed Action	Alternative A	No Action	Mitigation(s)
		SOCIOECONOMICS		
Increase in population	Negligible - adequate infrastructure exists; LOP	Negligible; LOP	No impact	Employ as many local personnel as possible; distribute impact assistance funds.
Increase in demand for temporary housing	Negligible to beneficial - numerous vacancies exist; LOP	Negligible; LOP	No impact	Employ as many local personnel as possible; distribute impact assistance funds.
Increase in demand for local government facilities or services	Negligible - adequate infrastructure exists and increased revenues will be available; LOP	Negligible; LOP	No impact	Employ as many local personnel as possible; distribute impact assistance funds.
Increase in demand for school services	Negligible - adequate classroom space available	Negligible; LOP	No impact	Employ as many local personnel as possible.
Disruption or change of character of communities	Negligible - towns developed during boom and bust cycles; LOP	Negligible; LOP	No impact	Employ as many local personnel as possible; distribute impact assistance funds.
Increase in tax revenue and royalties and stimulation of local economy	Beneficial - increased federal, state, and local revenues; LOP	Beneficial; LOP	Moderate- no increased revenues	None.
Increased employment	Beneficial; LOP	Beneficial; LOP	No impact	None.
		LAND USE		
Reduction of animal unit months (AUMs) for livestock and wildlife	Negligible - initial reduction of 243 AUMs and LOP loss of 93 AUMs	Negligible - initial reduction of 40 AUMs and LOP loss of 8 AUMs	No impact	Implement appropriate and timely reclamation; revegetate with palatable and productive species.
Loss of forage and/or wildlife due to fires started by the Windplant	Negligible; facilities monitored daily by O&M personnel and continually via communications systems; LOP	Negligible and reduced by approximately 40% from Proposed Action	Negligible- no early warning	Maintain WTGs in proper working condition at all times; prohibit outdoor smoking during high fire hazard periods; restrict vehicular traffic to approved roads.
Temporary loss of mineral development opportunities	Negligible - no active coal or uranium mines; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid active quarries.
Temporary loss of oil and gas development opportunities	Negligible - wind, oil, and gas may be compatible land uses	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid potential development areas, if possible.
Changes in character and recreational uses of the area due to construction, presence of facilities, noise, dust, odor, and increased human activities	Moderate - no developed recreation areas occur on KPPA; LOP	Moderate and reduced from Proposed Action depending on facilities placement	No impact	Maintain roads as appropriate; use equipment mufflers; minimize disturbance areas; implement appropriate and timely reclamation.
Potential increased tourism opportunities	Beneficial to local businesses	Beneficial but reduced approximately 40% from Proposed Action		

Table 2.11 (Continued)

Impact by Environmental Resource	Post-mitigation Impacts: Proposed Action	Alternative A	No Action	Mitigation(s)
LAND USE (Continued)				
Infringement on prior rights	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Avoid existing ROWs where feasible; use appropriate construction at ROW crossings.
VISUAL RESOURCES				
Modification in the basic elements (form, line, color, or texture) of visual resources by presence of facilities and equipment	Significant; LOP	Significant, but reduced by approximately 40% from Proposed Action, depending on facilities placement	No impact	Paint facilities with standard environmental colors and, where feasible, locate to blend with surrounding landscape; minimize cuts and fills and other visible landscape alterations; implement appropriate and timely reclamation and revegetation.
HAZARDOUS MATERIALS				
Soil, surface water, and groundwater contamination and wildlife exposure	Negligible; LOP	Negligible and reduced by approximately 40% from Proposed Action	No impact	Adhere to hazardous materials management and spill prevention and control countermeasure plans; implement appropriate monitoring, containment, and disposal of hazardous material.

[1] The term "beneficial" is used to describe the favorable impact of using a nonpolluting resource to generate electricity; it is not intended to reflect proactive air quality improvement (i.e., cleanup).

3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, socioeconomic, and visual resources of the proposed project area. The KPPA consists of the Foote Creek Rim and Simpson Ridge areas plus the 100-ft ROW along the three alternate transmission line routes (Map 1.1).

Critical elements of the human environment (BLM 1988a), their status on the project area, and their potential to be affected by the proposed project are listed in Table 3.1. Four critical elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, and wilderness) are not present in the KPPA and are not discussed further.

3.1 PHYSICAL RESOURCES

3.1.1 Climate and Air Quality

Climate within the KPPA is classified as continental, semiarid, cold desert (Trewartha and Horn 1980). Annual temperatures at Elk Mountain, 3.0 mi (4.8 km) southeast of the Simpson Ridge area, and at Arlington average 42 °F (6 °C). Average daily temperature at Elk Mountain ranges from 22 °F (-6 °C) in January to 64 °F (18 °C) in July, with an extreme high of 95 °F (35 °C) and an extreme low of -42 °F (-41 °C) (Martner 1986). Temperatures at Medicine Bow, 14.0 mi (22.5 km) north of Foote Creek Rim, average 21 °F (-6 °C) in January and 65 °F (18 °C) in July.

The KPPA is within the 10-14 inch (25-35 cm) precipitation zone (BLM 1987:135). Mean annual precipitation for the KPPA averages about 12 inches (31 cm) (Martner 1986), and approximately 44% of the annual precipitation occurs between March and June. Precipitation is lowest from December through February. Average annual snowfall is about 45.0 inches (114.3 cm) at Medicine Bow and 82.0 inches (208.3 cm) at Elk Mountain. Summer precipitation is generally produced by convective thunderstorms that seldom exceed 1.0 inch (2.5 cm) in total rainfall. The KPPA receives an average of 40 thunderstorms each year (Martner 1986). Mean annual pan evaporation is relatively high at 70 inches (177.8 cm).

The KPPA is located in a region of Wyoming known as the "Wind Corridor", where cold wind from the west is channeled eastward across the Continental Divide (Martner 1981, Marwitz and Martner 1981, Martner and Marwitz 1982) (see Section 1.1.2). Winds are predominantly from the west and southwest (Martner 1986). Annual wind speeds average from 4.5-21.5 mph (2.0-9.6 m/s), and speeds are greatest during the afternoon and in winter. The KPPA has some of the strongest and most persistent winds in the U.S.

Snow distribution has a marked effect on vegetation, wildlife, hydrology, and human activities. Snow distribution is determined by the effects of topography and vegetation on blowing snow, and in turn, vegetation and topography are affected by snow accumulation patterns. In the Foote Creek Rim area, the snow distribution pattern is governed by severe snow blowing conditions caused by a combination of heavy snowfall, strong persistent winds, gently rolling topography, and low-growing vegetation.

The snow accumulation season in the Foote Creek Rim area extends from November 10 to April 5. Snowfall over this period averages 95 inches (240 cm) at a nearby site described by Sturges (1986), of which approximately 60% is relocated by the wind. The top of Foote Creek Rim experiences severe snow blowing conditions during most of the winter. Quantities of blowing snow are estimated as the amount of snow that passes underneath an imaginary line 16 ft (5 m) above the ground (i.e., that passes through a column 16 ft tall and 3 ft wide (or 5 m tall and 1 m wide). On top of Foote Creek Rim, the quantity of blowing snow during the snow accumulation season averages 72 tons/foot (215 metric tons/m).

Table 3.1 Critical Elements of the Human Environment on the KPPA.

Element[1]	Status on KPPA	Addressed in Text of EIS
Air quality	Potentially affected	Yes
Areas of critical environmental concern	None present	No
Cultural remains	Potentially affected	Yes
Farmlands (prime or unique)	None present	No
Floodplains	Potentially affected	Yes
Native American religious concerns	Potentially affected	Yes
Threatened and endangered species	Potentially affected	Yes
Wastes, hazardous or solid	Potentially affected	Yes
Water quality	Potentially affected	Yes
Wetlands/riparian zones	No effects anticipated	Yes
Wild and scenic rivers	None present	No
Wilderness	None present	No

[1] As listed in BLM *NEPA Handbook H-1790-1* (BLM 1988).

The top of Foote Creek Rim is swept bare of snow throughout most of the winter, and therefore constitutes important winter range for deer, elk, and pronghorn antelope. Large drifts form on the leeward side of the rim, in north/south-trending draws, in stream channels, and on outlying hills at the northern end of the rim. These deposition areas are an important source of water for wildlife, livestock, irrigation, and recreation in the Rock Creek Valley. Large drifts also occur along Foote Creek and tributary channels near the southern end of the rim, and snow accumulates to depths of 11 inches (28 cm) or greater in areas occupied by sagebrush, primarily in swales and on the leeward side of hills.

Site-specific snow redistribution data for the Simpson Ridge area would be evaluated during preparation of the PODs for future phases of development. The factors controlling snow accumulation patterns in the Simpson Ridge area are similar to those on Foote Creek Rim (i.e., topography and vegetation), but topography is more rolling in the Simpson Ridge area, and sagebrush is more prevalent; therefore, snow distribution patterns would be different from patterns on Foote Creek Rim. In general, however, the Simpson Ridge area has windswept ridges that are blown free of snow, as well as protected areas (e.g., the leeward side of ridges, riparian zones, heavily vegetated areas) where snow accumulates.

Air quality in the region is generally good (BLM 1992a). The KPPA is located entirely within the Laramie Air Basin, which is designated as a Prevention of Significant Deterioration (PSD) Class II area under the WDEQ-Air Quality

Division (AQD) Implementation Plan (BLM 1987:152-168). PSD Class II areas are those that may be developed, and the release of limited concentrations of certain pollutants over ambient levels is permitted as long as National Ambient Air Quality Standards are maintained (WDEQ 1989). The nearest PSD Class I area (an area where little air quality deterioration is allowed) is the Savage Run Wilderness, located approximately 30 mi (48 km) south of the KPPA. The Savage Run Wilderness is managed as a PSD Class I area by the State of Wyoming, and therefore, is not a mandatory PSD Class I area (BLM 1992a).

The principal air quality pollutant in Wyoming is total suspended particulates (TSP) (BLM 1987:157). Fugitive dust (uncontrolled wind-carried particles) from natural sources, surface coal mines, highway construction, unpaved roads, and other types of development increases the ambient level of suspended particulates in and adjacent to the KPPA, particularly during dry windy conditions (BLM 1987). No violations of TSP Class II air quality standards are known for the KPPA (BLM 1987:157-161).

Ambient air quality was measured by WDEQ-AQD at Hanna from 1980-1983. Annual TSP concentrations averaged 22.8-66.7 micrograms per cubic meter ($\mu g/m^3$) (personal communication, December 1994, with Bob Schick, WDEQ-AQD). The standard for mean annual TSP in this area is 60 $\mu g/m^3$. The maximum 24-hr concentrations ranged from 87-228 $\mu g/m^3$ (the maximum 24-hr standard is 150 $\mu g/m^3$). In 1980, there were seven measurements above the standards.

Climatic factors such as prevailing winds, atmospheric stability, and mixing heights affect air quality by influencing the ability of air to disperse or dilute pollutants. Unstable conditions caused by vertical movement of air near the ground heated during the day and neutral air combined with moderate to high wind speeds provide conditions conducive to dispersing and diluting pollutants and maintaining air quality (BLM 1987:157). Unstable or neutral conditions, coupled with high wind speeds, occur more than 70% of the time throughout most of the GDRA.

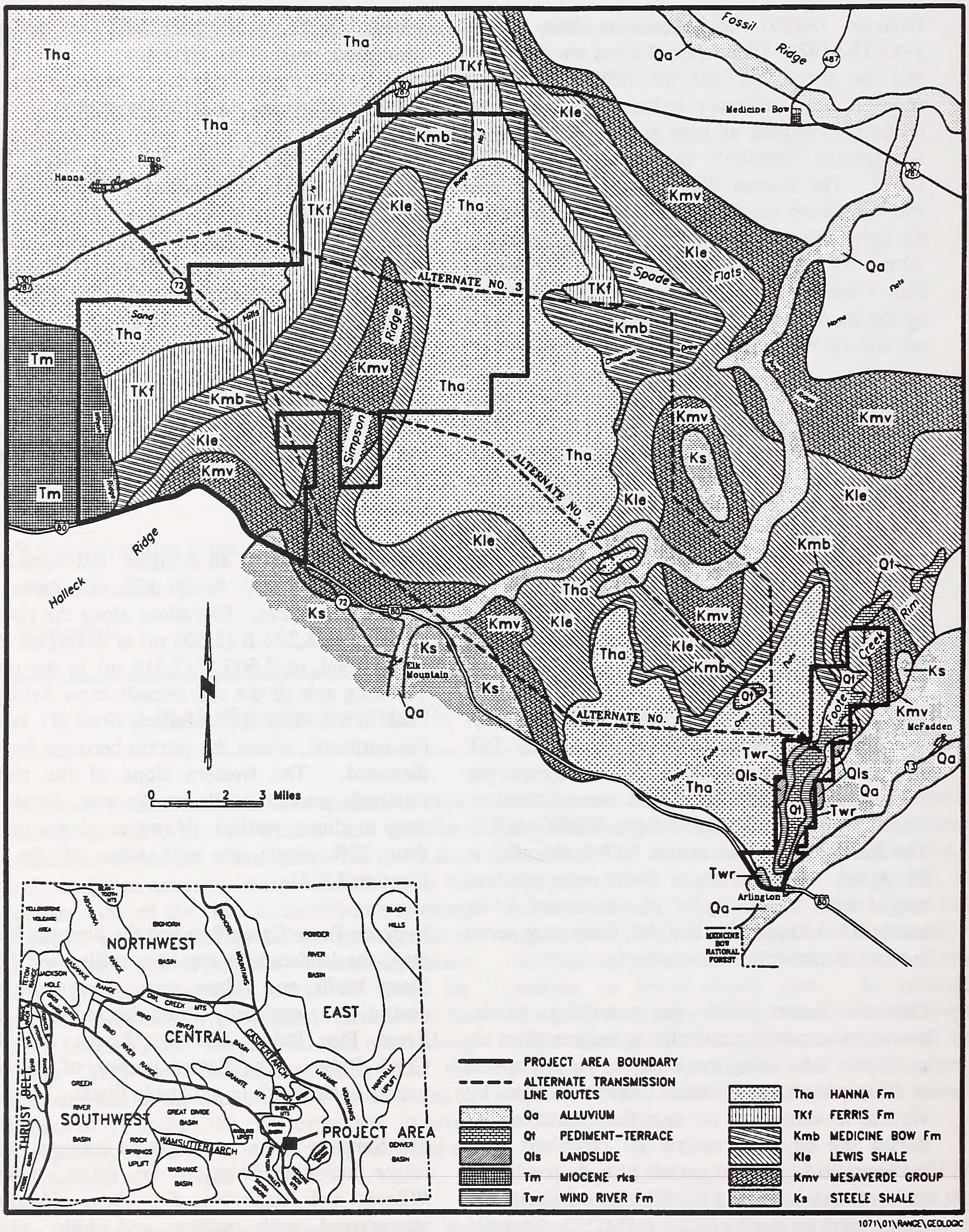
3.1.2 Topography and Physiography

The KPPA lies within the Wyoming Basin (Fenneman 1931), which contains four subordinate basins: the Hanna, Carbon, Laramie, and Saratoga Basins. Foote Creek Rim lies along the western edge of the Laramie Basin. The Simpson Ridge area and a majority of the three proposed transmission line routes are located on a structural divide separating the Hanna and Carbon Basins. The project area is bounded on the north by the Seminoe, Shirley, and Freezeout Mountains. To the east is the Laramie Basin, and to the south are the Medicine Bow Mountains and the Saratoga Valley. The Hanna Basin lies to the west (Map 3.1).

Foote Creek Rim is an elongate, flat-topped rim that rises 300-400 ft (91-122 m) above the surrounding plains. Elevations along the rim top range from 8,222 ft (2,506 m) at Arlington Peak in the south to 7,600 ft (2,316 m) in the north. The long axis of the rim extends from Arlington Peak in the south approximately 7 mi (11 km) to the northeast, where the terrain becomes heavily dissected. The western slope of the rim is relatively smooth, while on the east, slopes are steep to almost vertical. However, slopes greater than 25% occur on both sides of the rim (Section 3.1.4).

Between Foote Creek Rim and the Simpson Ridge area, the landscape is typically rolling and hilly. Steep bluffs and ridges occur throughout this central area, especially along the Medicine Bow River, Pine Ridge, Chimney Rocks, and Bear Creek Ridge. The flattest portion of this area occurs in the north (e.g., Spade Flats).

The Simpson Ridge area contains numerous steep ridges including Simpson, Hi Allen, Halleck, Wilson, and Ridge No. 5. These ridges are interspersed with rolling and hilly plains. Maximum elevation on Simpson Ridge is approximately 7,840 ft (2,390 m). The lowest



Map 3.1 Geology and Physiography of the KPPA.

elevation [6,700 ft (2,042 m)] occurs in the northeastern corner of the Simpson Ridge area.

In the Foote Creek Rim area, drainage is into Rock Creek on the east and into Foote Creek on the west. Both creeks are tributaries of the Medicine Bow River, which is part of the North Platte River system. The Medicine Bow River bisects the area between Foote Creek Rim and Simpson Ridge. Numerous intermittent (e.g., Wagonhound Creek) and ephemeral (e.g., Willow Springs Creek) channels drain this area into the Medicine Bow River. East of Simpson Ridge, drainage is into First Sand Creek, which flows northeast into Allen Lake, which has no outlet. West of Simpson Ridge, numerous ephemeral channels (e.g., Percy Creek, Kinney Creek) flow northwest into St. Mary's Creek, a tributary of the North Platte River.

3.1.3 Geology

The upper surface of Foote Creek Rim consists of unconsolidated Quaternary deposits of landslide debris, pediment and terrace gravels, and alluvium (Map 3.1) (Blackstone 1976, Love and Christiansen 1985). Strata on the flanks of Foote Creek Rim include the Tertiary Wind River, Hanna, and Medicine Bow Formations, and the Cretaceous Mesaverde Group and Lewis Shale. These formations are composed of claystones, sandstones, siltstones, conglomerates, and shales.

Simpson Ridge is an anticlinal structure that separates the Hanna Basin from the Carbon Basin (Blackstone 1976). The Cretaceous Steele Shale is the oldest formation in the Simpson Ridge/transmission line area (Map 3.1), and is composed of gray marine shale and abundant sandstone beds. The Mesaverde Group forms the main rock unit of Simpson Ridge, and is composed of sandstones, shales, conglomerates, and claystones intermixed with thin coalbeds. The Cretaceous Lewis Shale, the Tertiary Medicine Bow and Ferris Formations, and rocks of Miocene age outcrop throughout the Simpson Ridge area. These consist of shales, sandstones, conglomerates, and claystones (Love and Christiansen 1985). Because no subsurface resources would be affected by the proposed project, the stratigraphy of the KPPA will not be discussed.

3.1.3.1 Mineral Resources

Oil and Gas. Oil and gas were discovered in the Simpson Ridge Field in 1923 (Table 3.2) [Wyoming Oil and Gas Conservation Commission (WOGCC) 1992]. In 1992, there were 7 wells within the KPPA. Annual production of oil and gas from these wells in 1992 totaled 31,288 barrels (bbls) of oil and 9,720 thousand cubic feet (mcf) of gas. Cumulative production from the area has totaled 8 million bbls of oil and 9 million mcf (mmcf) of gas. Most production was obtained from wells completed in the Lance, Mesaverde, Sundance, Muddy, Casper, and Lakota Formations. Numerous other oil and gas fields occur in the vicinity of the transmission line routes (i.e., the Chapman Draw, Horne Brothers, Little Medicine Bow, Medicine Bow South, and Rock Creek Fields), but none of these fields are close enough to be affected by transmission line construction.

Coal. There are no active coal leases within the KPPA (personal communication, February 1994, with Mark Newman, Geologist, BLM, Rawlins). The Simpson Ridge project area lies on the eastern side of the Hanna Coal Field; Foote Creek Rim lies on the extreme western edge of the Rock Creek Coal Field (Jones 1991a, 1991b). Although there are areas of known thick or abundant coal underlying portions of the project area, only the northwestern portion of the Simpson Ridge area has coal development potential (BLM 1987:120-121). In-place coal reserves in the Hanna Coal Field are estimated at 3.27 billion tons (2.97 billion metric tons) (Wood and Bour 1988). As of 1979, the estimated remaining strippable reserve was 648.29 million tons (588.12 million metric tons) (Glass and Roberts 1979), primarily from the Hanna, Ferris, Mesaverde, and Medicine Bow Formations (Glass and Jones 1991). No coal has been or is expected to be recovered from the Rock Creek Coal Field in the foreseeable future.

Table 3.2 Oil and Gas Production from Fields Within the KPPA.

Field Name	Location Within the KPPA	Discovery Date	No. of Producing Wells	1992 Production Oil (bbls)	1992 Production Gas (mcf)	Cumulative Production Oil (bbls)	Cumulative Production Gas (mcf)
Big Medicine Bow	Alternate Transmission Line Route 3	1935	3	17,221	9,720	6,014,081	6,715,467
Diamond Ranch	Foote Creek Rim	1957	3	6,395	0	862,176	125,732
Elk Mountain	Alternate Transmission Line Route 1	1957	1	7,672	0	853,249	0
Simpson Ridge	Simpson Ridge	1923	SI[1]	0	0	277,074	2,534,705
Total			7	31,288	9,720	8,006,580	9,375,904

[1] SI = Shut in.

Future leasing and development will depend on the demand for coal-generated energy, the opening of new markets, and changes in technology to recover the Hanna Basin coal in a cost-effective manner. Coal in the Hanna Basin is deeply buried compared with coal in the Powder River Basin, and therefore, further development is unlikely in the near future.

Coalbed Methane. An estimated 0.135-2.7 trillion cubic feet of coalbed methane gas resources occur within the Hanna-Laramie Basin coal fields (DeBruin and Jones 1989). Metfuel Wyoming, Inc. has completed extensive testing for coalbed methane in the Hanna Basin approximately 7 mi (11 km) north of the Simpson Ridge area (BLM 1993a). Two wells completed in Hanna Formation coals produced 291,000 cubic feet (cf) of gas and 214,000 bbls of water during the first six months of 1991 (Glass 1991), but near future development of this resource is not economical. Potential methane-bearing coalbeds of the Hanna, Harris, Medicine Bow, and Mesaverde Formations are present throughout the KPPA. Currently, there are no coalbed methane leases within the KPPA, and due to the economic uncertainties of recovering this resource, development in the project area is unlikely in the near future.

Locatable Minerals. There are no uranium leases or claims within the KPPA. Uranium has been produced from the Tertiary Wind River Formation in the Shirley Basin (Harris et al. 1985), but there are no known uranium deposits within the project area (BLM 1987:126). No other locatable minerals (e.g., precious metals, bentonite) are known to exist in sufficient quantities for economical recovery (BLM 1987:126; Harris et al. 1985).

Salable Minerals. Salable minerals within the project area include sand, stone, gravel, clay, and scoria. Sand and gravel are being excavated from deposits near Simpson Ridge and along the Medicine Bow River (Harris and Meyer 1986). Terrace sand and gravel deposits occur at the northern end of Foote Creek Rim and immediately west of Foote Creek Rim, and other recoverable deposits of sand, gravel, stone, scoria, and/or clay

probably occur in isolated deposits throughout the KPPA (Harris and Meyer 1986).

3.1.3.2 Geologic Hazards

The potential for seismic activity within the KPPA is low [personal communication, May 1994, with James Case, Wyoming Geological Survey (WGS)], and there are no known or suspected active faults in the area (Case et al. 1990). An earthquake with an epicenter in the northern portion of the Simpson Ridge area occurred on August 17, 1973 (Case 1986) (Map 3.2). Three earthquakes with intensities of III to IV on the modified Mercali scale occurred near Medicine Bow between 1938 and 1955. Intensity III and IV earthquakes are noticeably felt indoors, but only barely, if at all, noticeable outdoors. The Seminoe Reservoir area in the northern part of the Hanna Basin experienced five earthquakes with magnitudes of 2.9-3.1 (Richter scale) between 1989 and 1993 (Case 1990, 1994). The Richter scale is a quantitative measure of the magnitude (i.e., the relative amplitude of ground motion caused by seismic waves) of an earthquake. Intensity is a qualitative estimate of the perceived amount of ground shaking (Case 1986).

Landslide areas occur along the eastern and western slopes of Foote Creek Rim and on isolated steep slopes in the Simpson Ridge areas (Map 3.2) (Case 1992a, 1992b, 1992c, 1992d, 1992e). The predominant landslide types on Foote Creek Rim include multiple rock slides, multiple flows (earth or debris-laden earth), multiple slumps, slump/flow complexes, flows (earth or debris-laden earth), and backslides. In the Simpson Ridge area, the major landslide types are multiple block slides, multiple rock slides, multiple flows, and multiple slumps. Preliminary landslide maps are not available for the Hanna, Como East, and Como West U.S. Geological Survey (USGS) quadrangles (approximately 31% of the proposed project area).

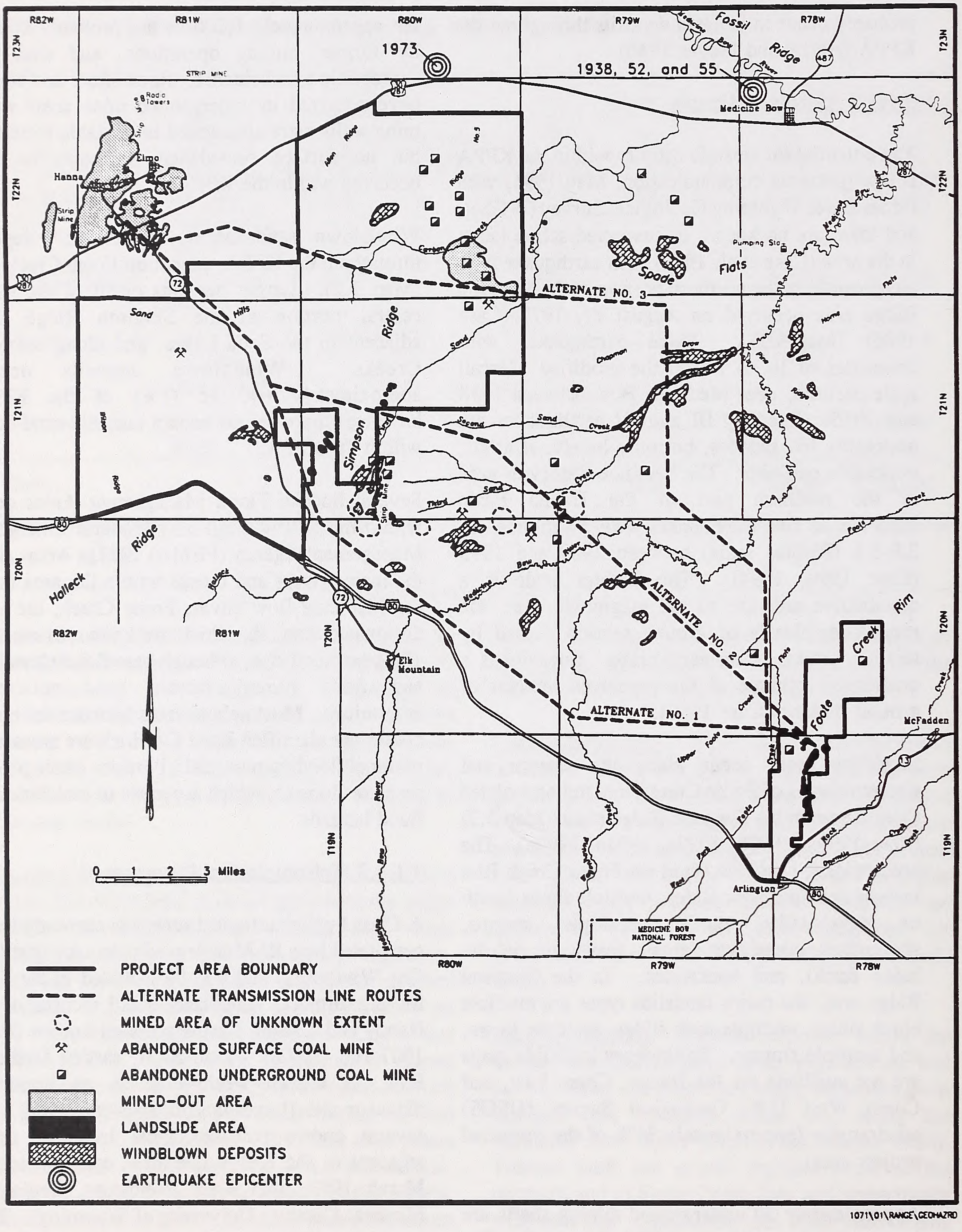
Approximately 30 underground mining shafts are known to exist within the KPPA (Map 3.2). The areal extent of the underground mines is unknown, but approximately 1,200 ac are probably affected by former mining operations, and thus, are susceptible to subsidence. Rock slides and slumps have occurred in underground mine areas where mine walls were abandoned in unstable condition, but no surface subsidence is known to have occurred within the KPPA.

Windblown sand occurs in isolated deposits throughout the KPPA, except on Foote Creek Rim (Map 3.2). Larger deposits occur in the north-central portion of the Simpson Ridge area, adjacent to the Soda Lakes, and along the Sand Creeks. Windblown deposits occupy approximately 640 ac (1%) of the KPPA; however, there are no known unstable sand dunes within the KPPA.

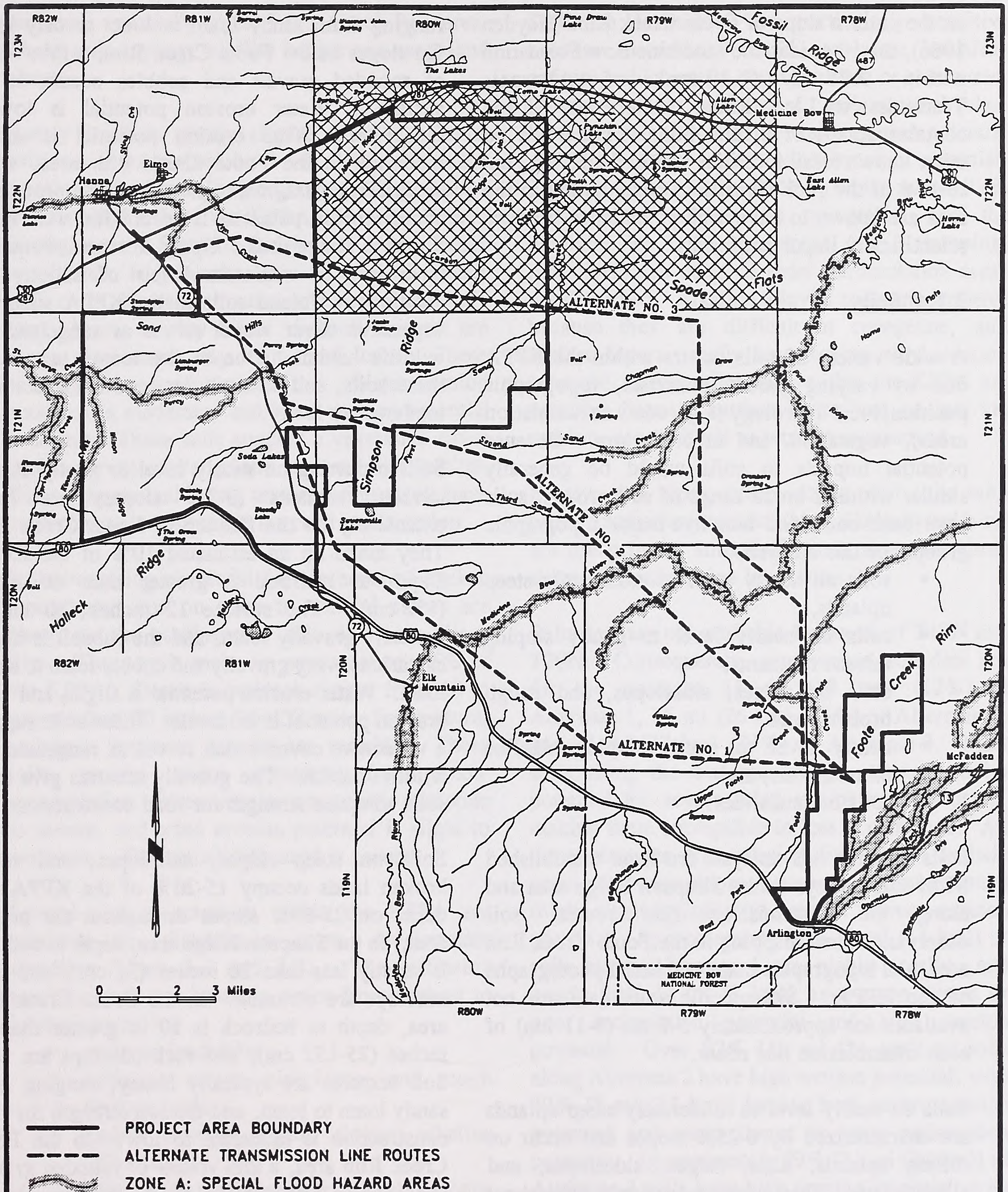
Several Special Flood Management Areas occur within the KPPA (Map 3.3) [Federal Emergency Management Agency (FEMA) 1987]. Areas along the major rivers and creeks within the area (e.g., the Medicine Bow River, Foote Creek, etc.) are designated Zone A, which are known as areas of 100-year flood risk, although base flood elevations and flood hazard factors have not been determined. Most upland areas between the major creeks are classified Zone C, which are areas with minimal flooding potential. Portions of the project area are Zone D, which are areas of undetermined flood hazards.

3.1.3.3 Paleontological Resources

A Class I paleontological survey is currently being completed by a BLM-approved paleontologist (Dr. Gus Winterfeld) and will be included in the FEIS for this project. Important fossil records of the Hanna and Carbon Basins are well-known (BLM 1987:106, 1992). Como Bluff, east of Medicine Bow, is known world-wide as an important dinosaur site (Lageson and Spearing 1988), and several known paleontological localities occur adjacent to the KPPA (personal communication, March 1993, with Brent Breithaupt, Geological Museum Curator, University of Wyoming). Two known localities occur in or immediately adjacent to the KPPA; one is in the Wind River Formation



Map 3.2 Geologic Hazards.



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Map 3.3 Surface Water Resources and Flood Management Areas.

on the eastern slope of Foote Creek Rim (Hayden 1966), the other is in the Medicine Bow Formation within 0.25 mi (0.40 km) of Alternate Transmission Line Route (Alternate) 3 and contains scraps of a limb bone. There are no other known fossil localities within the KPPA, but several of the rock formations outcropping in the area are known to have high potential to produce scientifically important fossils.

3.1.4 Soils

A wide variety of soils occurs within the KPPA due to varying parent materials, topographic position, local hydrology (e.g., snow accumulation areas), vegetation, and other factors. Because potential impacts to soils would be generally similar within a broad range of soil groups, soils have been combined into five major topographic groups for this analysis:

- soils on nearly level to moderately steep uplands,
- soils on nearly level to gently sloping terrace remnants,
- soils on ridges, sideslopes, and rough broken lands,
- nearly level to gently sloping alkaline alluvial soils, and
- soils on landslides.

Soils data for this analysis are from unpublished BLM soil surveys in the Simpson Ridge area and along the transmission line routes, soil observations and mapping in the Foote Creek Rim area, and topographic maps and aerial photographs of the KPPA. Site-specific soils data are not available for approximately 5-7 mi (8-11 km) of each transmission line route.

Soils on nearly level to moderately steep uplands are characterized by 0-25% slopes and occur on rolling uplands, hills, ridges, sideslopes, and alluvial fans. They occur extensively throughout the study area, occupying approximately 65% of the KPPA. Depth to bedrock is mostly 20 to greater than 60 inches (51-152 cm), although in some areas, soil depth is less than 20 inches (51 cm). Soil textures are typically loamy, ranging from sandy loam to loam to clay loam. On slopes below Foote Creek Rim, a thin veneer of rounded gravels and cobbles occurs on the surface. Water erosion potential is low to moderate. Wind erosion potential is mostly moderate in the Foote Creek Rim area, where surface rock fragments provide some protection. Wind erosion potential is severe for soils in the Simpson Ridge area. Upper horizons frequently have low to moderate levels of salinity and alkalinity. Upland soils in the KPPA support a vegetative cover which serves as rangeland and wildlife habitat. Due to the loamy textures of these soils, soil strength for road construction is moderate to low.

Soils occurring on nearly level to gently sloping terrace remnants (0-3% slopes) are found extensively on the flat top of Foote Creek Rim. They make up an estimated 10% of the KPPA. Depth to bedrock is greater than 60 inches (152 cm). The surface 12 inches (30 cm) is typically gravelly loam, and the subsoil is highly calcarious, very gravelly and cobbly loam to sandy loam. Water erosion potential is slight, and wind erosion potential is moderate. These soils support a vegetative cover which serves as rangeland and wildlife habitat. The gravelly textures give these soils adequate strength for road construction.

Soils on steep ridges, sideslopes, and rough broken lands occupy 15-20% of the KPPA and occur on 25-60% slopes throughout the project area. In the Simpson Ridge area, depth to bedrock is mostly less than 20 inches (51 cm), and rock outcrops are common. In the Foote Creek Rim area, depth to bedrock is 10 to greater than 60 inches (25-152 cm), and rock outcrops are rare. Soil textures are typically loamy, ranging from sandy loam to loam, and the soil strength for road construction is moderate to low. In the Foote Creek Rim area, a thin veneer of rounded gravels and cobbles often occurs on the surface. In the Simpson Ridge area, shallow soils may contain many flat, angular sandstone fragments. Water and wind erosion potential is moderate to severe. These soils may occur on landslides in areas where snow accumulation causes a buildup of excess soil

moisture, especially in the Foote Creek Rim area. These soils support wildlife habitat and rangeland plants.

Nearly level to gently sloping alkaline alluvial soils are characterized by 0-6% slopes and occur on alluvial fans and along drainages. They occupy an estimated 5% of the KPPA and are scattered throughout the Simpson Ridge area only. Depth to bedrock is generally greater than 60 inches (152 cm). Surface textures are very fine sandy loam, loam, or clay loam. Subsoil textures are sandy clay loam, clay loam, and loam. These soils are very strongly alkaline. Water erosion potential is moderate, and wind erosion potential is severe. These soils support a vegetative cover which serves as rangeland and wildlife habitat. Due to clayey and loamy textures, these soils have moderate to low strength for road construction.

Soils occurring on landslides, in areas of broken topography, and on steep to vertical slopes are found on the southeastern side of Foote Creek Rim. These soils make up approximately 5% of the KPPA. Depth to bedrock ranges from 10 to greater than 60 inches (25-152 cm). Soil textures and rock fragment content are variable. These soils receive extra moisture from snow accumulation. Water erosion potential is moderate to severe, and wind erosion potential is slight to moderate. The landslide hazard is severe.

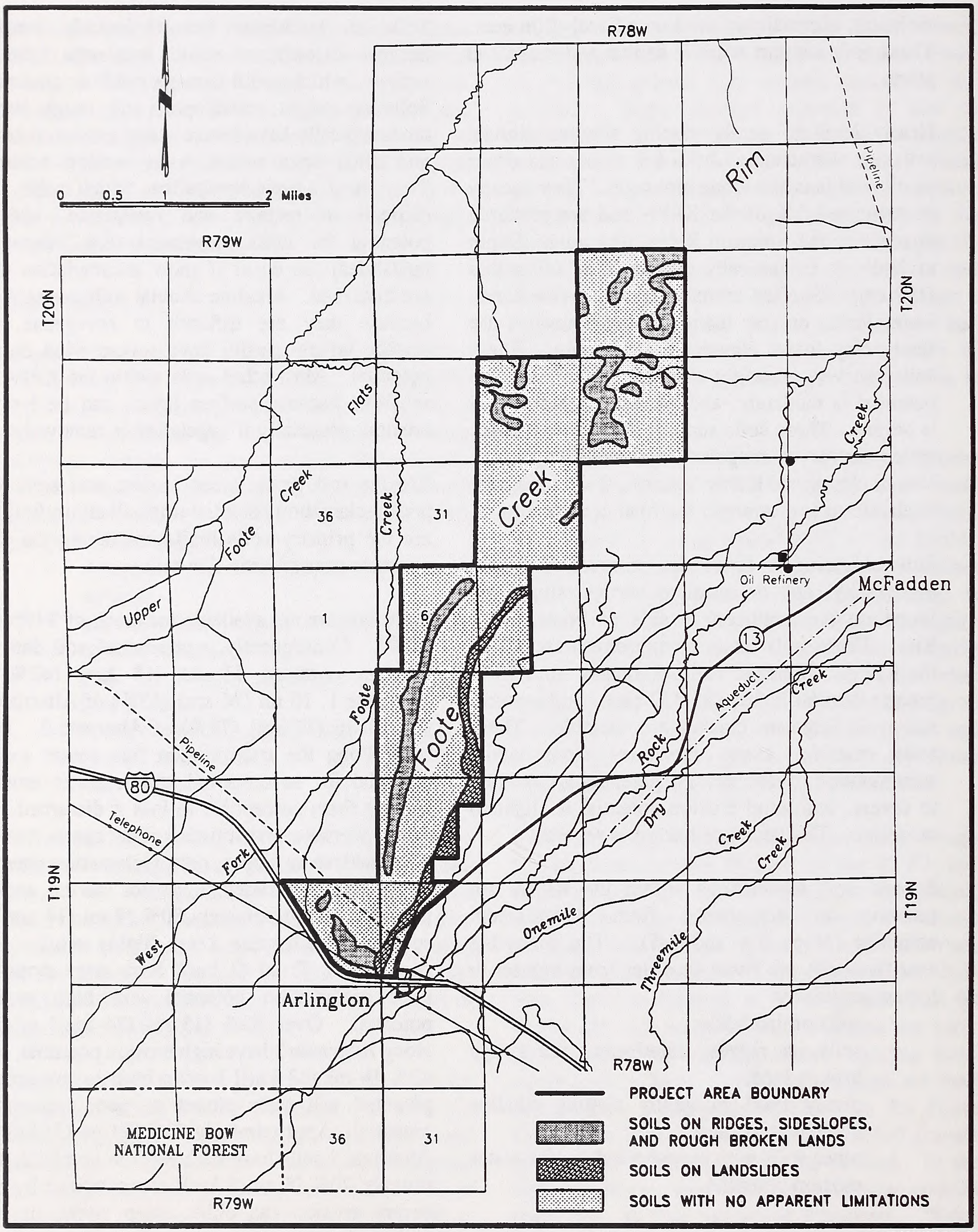
Several soil associations within the KPPA are sensitive to disturbance from development activities (Maps 3.4 and 3.5). The following sensitive soils are listed in order from highest to lowest sensitivity:

- soils on landslides,
- soils on ridges, sideslopes, and rough broken lands,
- nearly level to gently sloping alkaline alluvial soils, and
- other soils with severe wind and/or water erosion potential.

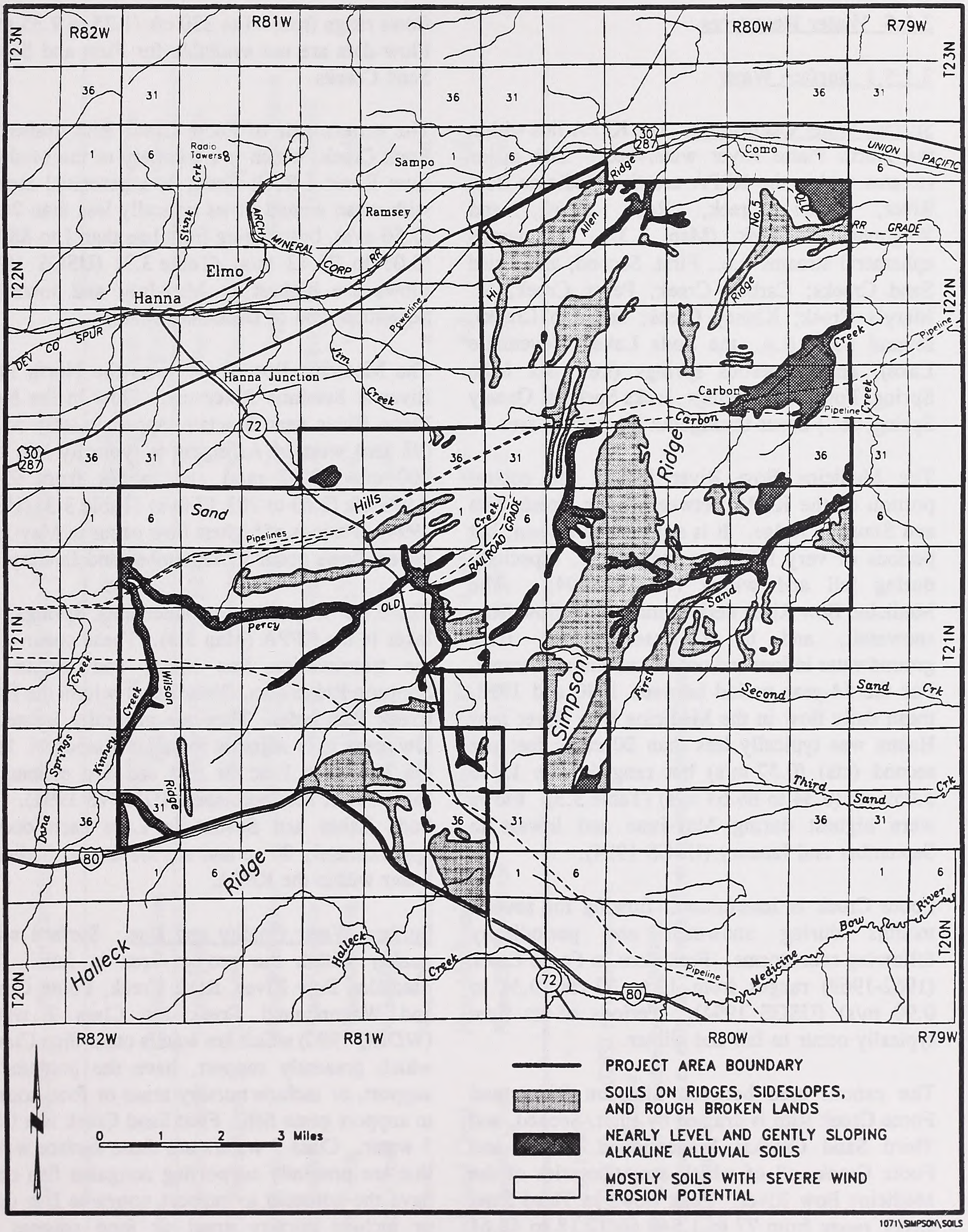
Soils on landslides are particularly sensitive because disturbance could accelerate landslide activity, which could damage roads or structures. Soils on ridges, sideslopes, and rough broken lands typically have severe water erosion potential and often have severe wind erosion potential. They are also typically shallow, which makes them difficult to reclaim and revegetate, and the potential for mass movement (e.g., slumping, landslides) can occur if snow accumulation areas are disturbed. Alkaline alluvial soils are sensitive because they are difficult to revegetate, and surface layers usually have severe wind erosion potential. Most other soils within the KPPA are sensitive because surface layers can be lost via erosion, especially if vegetation is removed.

Erosive soil types, steep slopes, and soils with poor reclamation potential (high alkalinity/salinity) are the primary soils limitations along the three alternate transmission line routes.

Soils data are not available for much of T19N and T20N. Consequently, summarized soil data are for the northern 11 mi (18 km) (42%) of Alternate 1, 16 mi (26 km) (65%) of Alternate 2, and 23 mi (37 km) (79%) of Alternate 3. Most soils along the transmission line routes exhibit potential for severe wind and/or water erosion, making them susceptible to loss if disturbed. All three alternate transmission line routes include areas with steep slopes, poor reclamation potential (high alkalinity/salinity), and/or severe erosion potential. Approximately 80% [9 mi (14 km)] of soils along Alternate 1 are highly erosive, and nearly 20% [2 mi (3 km)] have steep slopes or poor reclamation potential and high erosion potential. Over 92% [15 mi (24 km)] of soils along Alternate 2 have high erosion potential, with 42% [8 mi (13 km)] having both severe erosion potential and steep slopes or poor reclamation potential. Approximately 89% [21 mi (34 km)] of Alternate 3 soils have high erosion potential, with roughly 20% [5 mi (8 km)] characterized by both severe erosion and either steep slopes or poor reclamation potential.



Map 3.4 Locations of Sensitive Soils, Foote Creek Rim Area.



Map 3.5 Locations of Sensitive Soils, Simpson Ridge Area.

3.1.5 Water Resources

3.1.5.1 Surface Water

Surface Water Occurrence. The KPPA lies within the North Platte River watershed. The major streams within the KPPA are the Medicine Bow River, Foote Creek, Rock Creek, and Wagonhound Creek (Map 3.3). Numerous ephemeral streams (i.e., First, Second, and Third Sand Creeks; Carbon Creek; Percy Creek; St. Mary's Creek; Kinney Creek; and Jim Creek), several lakes (i.e., the Soda Lakes, Sevenmile Lake), and numerous springs (i.e., Six Mile Spring, Four Mile Springs, Jacks Springs, Quealy Spring, etc.) occur throughout the project area.

The Medicine Bow River bisects the central portion of the KPPA between Foote Creek Rim and Simpson Ridge. It is a perennial stream, but periods of very low flow may occur, especially during fall and winter (USGS 1994). The Medicine Bow River derives most of its flow from snowmelt, and to a lesser extent, from groundwater inflow and occasional thunderstorms. For the 54-year period between 1940 and 1993, mean daily flow in the Medicine Bow River near Hanna was typically less than 20 cubic feet per second (cfs) (0.57 m/s) but ranged from 12 to 3,059 cfs (0.34 to 86.63 m/s) (Table 3.3). Flows were highest during May-June and lowest in September and January (USGS 1994).

Foote Creek is intermittent, flowing for several months during snowmelt and periodically following rain storms. Peak flow in Foote Creek (1962-1969) ranges from 12 to 32 cfs (0.34 to 0.90 m/s) (USGS 1994). Periods of no flow typically occur in fall and winter.

The central area between Simpson Ridge and Foote Creek Rim is drained by First, Second, and Third Sand Creeks; Wagonhound Creek; and Foote Creek; all of which are tributaries of the Medicine Bow River. Peak flows in Third Sand Creek range from 77 to 1,540 cfs (2.18 to 43.61 m/s) (USGS 1994). Wagonhound Creek is perennial for the first 2 mi north of I-80; peaks flows range from 44 to 330 cfs (1.25 to 9.35 m/s). Flow data are not available for First and Second Sand Creeks.

The eastern side of Foote Creek Rim drains into Rock Creek, which is a tributary of the Medicine Bow River. Rock Creek is a perennial stream, with mean annual flows typically less than 20 cfs (0.56 m/s), but ranging from less than 1 to 887 cfs (0.03 to 25.12 m/s) (Table 3.3) (USGS 1994). Flows are highest in May-July and lowest in September and in December-March.

The Medicine Bow River joins the North Platte River at Seminoe Reservoir. Flow in the North Platte River near Sinclair, approximately 55 mi (88 km) west of Arlington is typically less than 700 cfs (19.82 m/s) and ranges from 93 to 9,999 cfs (2.63 to 283.17 m/s) (Table 3.3) (USGS 1994). Periods of highest flow occur in May-July; lowest flows occur in September and January.

There are 15 ponds, impoundments, springs, and lakes in the KPPA (Map 3.3). These occur along the transmission line routes and within the Simpson Ridge area. None occur within the Foote Creek Rim area. They are generally located in low areas in or adjacent to major drainages. Most are less than 1 ac in size and are ephemeral, seasonal, or semipermanent (USFWS 1991). The Soda Lakes and Sevenmile Lake each occupy approximately 80 ac and are the largest bodies of water within the KPPA.

Surface Water Quality and Use. Surface water quality within the project area is fair. The Medicine Bow River, Rock Creek, Foote Creek, and Wagonhound Creek are Class 2 waters (WDEQ 1990) which are waters other than Class 1 which presently support, have the potential to support, or include nursery areas or food sources to support game fish. First Sand Creek is a Class 3 water. Class 3 waters are those surface waters that are presently supporting nongame fish only, have the potential to support nongame fish only, or include nursery areas or food sources for nongame fish only.

Table 3.3 Discharge Rates for Streams Within the KPPA and in the North Platte River.[1]

Stream	Station Location	Period of Record/No. of Years	Range of Discharge (cfs)[2]	Typical Discharge (cfs)	Peak Flow Periods	Low Flow Periods
Medicine Bow River	Near Hanna	1940-1993/54	12-3,059[3]	<20	May-June	Sept., Jan.
North Platte River	Sinclair	1940-1993/54	93-9,999[3]	<700	May-July	Sept., Jan.
Rock Creek	Near Rock River	1941-1968/20[4]	<1-382[3]	<20	June	Sept., Dec.-March
Rock Creek	Near Arlington	1966-1993/28	7-887[3]	<20	May-July	Dec.-March
Foote Creek	Near Arlington	1962-1969/7	12-32[5]	n.d.[6]	n.d.	n.d.
Kinney Creek	Near Hanna	1963/1	6[5]	n.d.	n.d.	n.d.
Bear Creek	Near Elk Mountain	1962-1974/13	15-141[5]	n.d.	n.d.	n.d.
Third Sand Creek	Near Medicine Bow	1965-1981/17	77-1,540[5]	n.d.	n.d.	n.d.
Wagonhound Creek	Near Elk Mountain	1962-1974/13	44-330[5]	n.d.	n.d.	n.d.

1 USGS (1994).
2 Multiply cfs by 0.02832 to compute m/s.
3 Average daily flow.
4 No data are available for 1943-1950.
5 Peak flow only (i.e., only the greatest flow was recorded each year).
6 n.d. = no data.

Third Sand Creek, St. Mary's Creek, and the Soda Lakes are Class 4 waters, which do not have the hydrologic or natural water quality potential to support fish. Class 4 waters are protected for agricultural and wildlife watering uses. The North Platte River in the vicinity of the project area is a Class 1 stream, in which no further water quality degradation by point source discharges will be allowed (WDEQ 1990).

The watershed of Second and Third Sand Creeks, located southeast of the Simpson Ridge area and crossed by Alternates 2 and 3, is identified in the GDRA RMP as an "area needing special management" due to the high potential for accelerated erosion and sedimentation in the Medicine Bow River (BLM 1987:147). This area has naturally high rates of erosion, exhibited by deep gullies, steep headcuts in the upper reaches of the watershed, and severe piping along channel banks, which in places has been aggravated by land use practices (BLM 1978). While no specific erosion control measures have been implemented in the watershed, the management goal is to reduce the sediment load in the Medicine Bow River, and thereby, improve water quality for fisheries.

Table 3.4 presents surface water quality data for major streams within the KPPA and the North Platte River. Both Rock Creek (near Rock River) and the Medicine Bow River may have high levels of total dissolved solids (TDS), making these streams unsuitable for domestic uses, but generally suitable for livestock. Existing data for these two streams indicate that they are high in sulfates, calcium, bicarbonate, magnesium, sodium, and chloride (USGS 1994). The North Platte River has substantially lower concentrations of TDS and the major ions.

In a qualitative assessment of water quality in the Medicine Bow River, all major surface water uses are supported, including primary contact recreation (i.e., swimming), livestock and wildlife watering, human health value criteria, industry, and irrigation (Gumtow 1994). Human health value criteria are not a use, but are a suite of water quality standards; waters that meet or are assumed to meet these standards are classified as supporting human health value criteria. Use as a cold water fishery is only partially supported. The causes of water quality impairment in the Medicine Bow River are sediment and silt loading and nutrient enrichment. These impairments are caused by irrigation and rangeland erosion.

None of the surface water quality gaging stations on the North Platte River are sufficiently near the KPPA to provide a meaningful evaluation of baseline water quality with which to assess potential impacts of the project on the North Platte River. Therefore, no surface water quality data are provided for the North Platte River.

3.1.5.2 Groundwater

Groundwater Occurrence. Groundwater within the KPPA occurs in both confined (artesian) and unconfined (water table) aquifers (Daddow 1986). Aquifers within the KPPA would be only minimally affected by the proposed project during foundation drilling for turbine towers and for transmission line structures, and therefore, groundwater resources are not discussed in detail.

Quaternary alluvial deposits along the larger streams within the KPPA are the primary surficial aquifers in the KPPA. These alluvial aquifers consist of highly permeable unconsolidated sand and gravel, and typically yield large quantities of water [up to 1,000 gpm (3,785 l/min)] (Richter 1981). Groundwater in shallow aquifers generally moves towards local surface drainages. Alluvial deposits along the Medicine Bow River and Rock Creek may be up to 100 ft (30.7 m) thick (Lowry et al. 1973), and thus, have the capacity to store large amounts of water. Measured water yields from wells drilled in rock formations within and adjacent to the KPPA range from very low [1 gpm (3.8 l/min)] to moderate [150 gpm (567.8 l/min)] (Richter 1981). Springs typically discharge 1 to 10 gpm (3.8 to 37.8 l/min).

The primary source of recharge in the KPPA is from infiltration of snowmelt and runoff water

Table 3.4 Surface Water Quality Data.[1]

Location	pH (S.U.)[2]	Hardness (mg/l[3] as $CaCO_3$)[4]	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Sulfate (mg/l)	TDS (mg/l)	Suspended Sediments (mg/l)
North Platte River (Sinclair) (1983-93)	6.8-8.6	62-270	17-74	3.5-35	9.1-47	1.8-30	19-190	96-464	3-372[5]
Rock Creek (Arlington) (1966-67)	7.2-7.8	30-59	10-18	1.3-3.5	1-3	0-0.4	0-10	39-75	N/A
Rock Creek (Rock River) (1964-68)	7.3-8.2	290-1,100	67-200	35-150	63-230	7.1-31	260-1,300	558-1,810	N/A
Medicine Bow River (Hanna) (1983-89 except 1986-87)	7.8-9.1	170-820	42-190	16-84	27-150	4.7-64	120-780	285-1,360	10-2,890[6]

1 USGS (1994).
2 S.U. = Standard units.
3 mg/l = Milligrams per liter.
4 $CaCO_3$ = Calcium carbonate.
5 1986-93 only.
6 1987-89 only.

where formations outcrop at the surface (Richter 1981). Recharge also occurs where streams cross permeable rock outcrops and from vertical flow from adjacent aquifers. Discharge occurs mainly in surface playas, streams, and springs, especially in the vicinity of the Medicine Bow River and its tributaries.

Groundwater Quality and Use. Groundwater quality in surficial aquifers within the KPPA is generally good. Alluvial aquifers typically contain good quality groundwater (TDS less than 500 mg/l), with calcium, magnesium, and bicarbonate as the dominant ions (Richter 1981). Alluvial aquifers supply the majority of groundwater for domestic users.

TDS in the Ferris, Hanna, and Medicine Bow aquifers range from 400 to 9,000 mg/l (Freudenthal 1979; Richter 1981). The dominant ions in groundwater in these formations are sodium, magnesium, and sulfate. Groundwater from the Wind River Formation typically has a lower TDS concentration than the other Tertiary aquifers, with calcium and bicarbonate as the dominant ions. Groundwater in some areas may be high in radionuclides due to groundwater contact with uranium-bearing rocks, and locally, the Ferris Formation may have selenium and fluoride levels in excess of EPA Primary Drinking Water Standards (WDEQ 1990). The Hanna and Ferris Formations also contain localized areas where cadmium, chromium, iron, lead, and mercury levels exceed EPA standards (Richter 1981).

Groundwater from the Mesaverde aquifer generally has less than 1,200 mg/l TDS, and water quality tends to be better in outcrop areas. The dominant ions in Mesaverde groundwater are sodium, bicarbonate, and sulfate (Richter 1981).

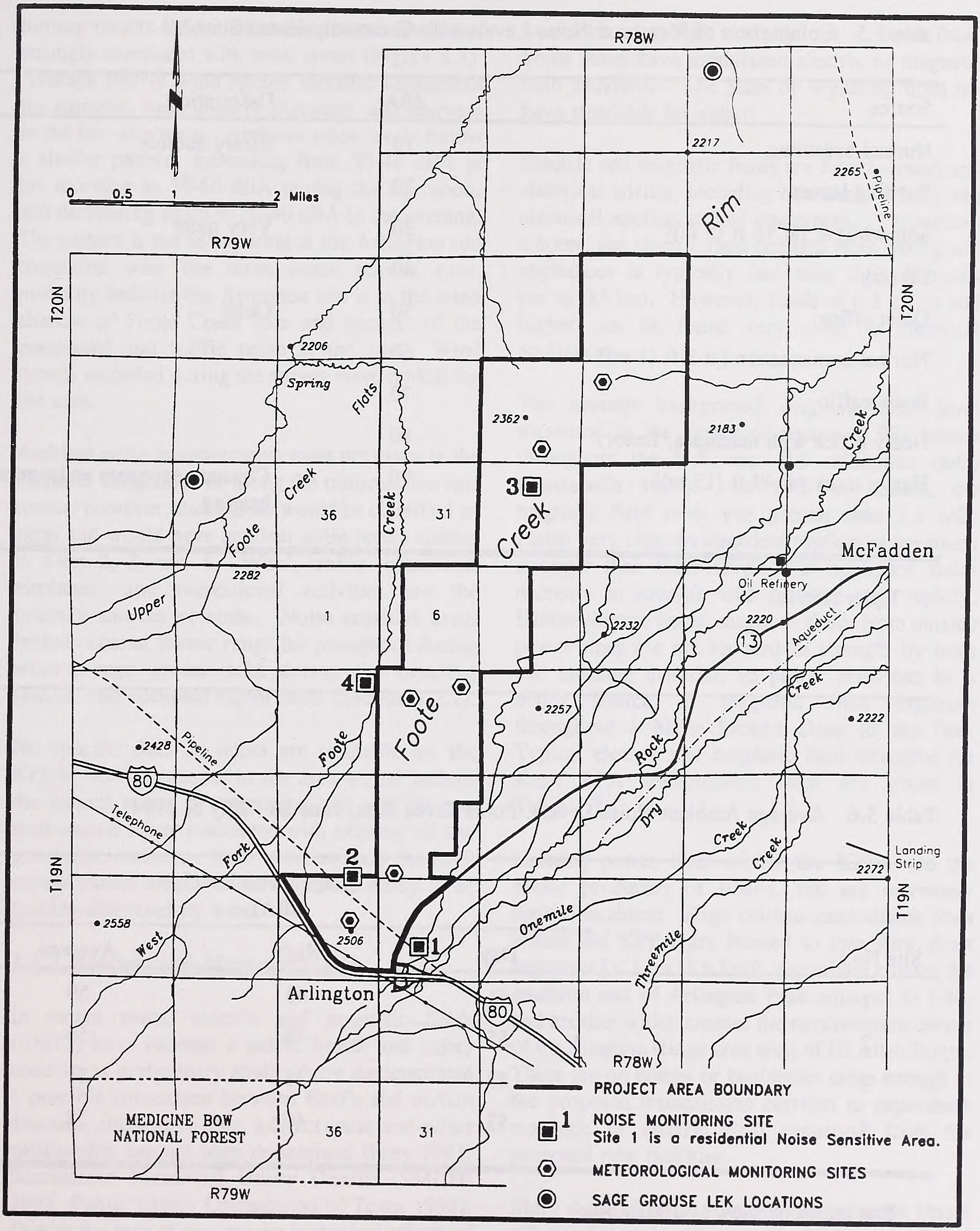
Radionuclide analyses from 15 wells in and adjacent to the KPPA showed that radium-226 concentrations [up to 2.1 picocuries/liter (pCi/l)] are below EPA standards (5 pCi/l). While there is no standard for uranium levels, most groundwater in the region contains less than 10 μg/l of uranium.

3.1.6 Noise and Odor

Wind, traffic on I-80 and other roads, residential activities, and animals are the primary sources of ambient noise in the Foote Creek Rim area. During a 1994 survey, existing ambient noise levels were monitored continuously at four locations within the Foote Creek Rim area (Map 3.6) between June 28 and July 5. Survey methods followed the American Wind Energy Association (AWEA) *Procedure for Measurement of Acoustic Emissions from Wind Energy Turbine Generator Systems* (AWEA 1989). Sound level meters with microphones were used to record ambient noise levels. Microphones were shielded with wind screens to minimize the abrasive noise of wind blowing over microphone surfaces.

The A-weighted sound pressure level, or A-scale, is used extensively in the U.S. for the measurement of community and transportation noise. The A-scale is a measure of noise, in A-weighted decibels (dBA), which is directly correlated with some commonly heard sounds (Table 3.5). Noise-sensitive receptors in the Foote Creek Rim area include single-family residences and a KOA campground in Arlington (Map 3.6). Two sage grouse leks were also identified as possibly sensitive areas.

The ambient noise level survey indicated that the predominant noise at all four monitoring sites was wind. Ambient noise levels typically ranged from 40 to 55 dBA (Table 3.6), which corresponds to noise levels ranging from levels heard in a library (40 dBA), a quiet office (50 dBA), and normal conversation (55 dBA). At Site 1, the residential area at Arlington, daytime noise levels averaged 61 dBA, and the overall day/night average was 59 dBA (equivalent to the level of a normal conversation). The ambient levels near Arlington may be higher than at the three more remote sites due to local residential activities and I-80 traffic.



Map 3.6 Noise Level and Meteorological Monitoring Sites, and Sensitive Receptor Locations, Foote Creek Rim.

Table 3.5 Comparison of Measured Noise Levels with Commonly Heard Sounds.[1]

Source	dBA	Description
Normal breathing	10	Barely audible
Rustling leaves	20	
Soft whisper [at 16 ft (5 m)]	30	Very quiet
Library	40	
Quiet office	50	Quiet
Normal conversation [at 3 ft (1 m)]	60	
Busy traffic	70	
Noisy office with machines; factory	80	
Heavy truck [at 49 ft (15 m)]	90	Constant exposure endangers hearing

[1] Tipler (1991).

Table 3.6 Average Ambient Noise Levels, Foote Creek Rim, June 28 - July 5, 1994.

	Average Noise Level (dBA)		
Site No.[1]	Day	Night	Average
1	61	43	59
2	55	48	56
3	53	33	51
4	53	40	52

[1] Site locations shown on Map 3.6.

Survey results show that ambient noise levels are strongly correlated with wind speed (Figure 3.1). Average hourly wind speeds increase throughout the morning, peak in early afternoon, and decrease in the late afternoon. Ambient noise levels follow a similar pattern, increasing from 30-40 dBA in the morning to 50-60 dBA during the afternoon, and decreasing again to 30-40 dBA in the evening. The pattern is not as apparent at the Arlington site compared with the three more remote sites, probably because the Arlington site is in the wind shadow of Foote Creek Rim and because of the residential and traffic noise at the site. Wind speeds recorded during the survey were typical for the area.

Ambient noise measurements were not made in the Simpson Ridge area or along the transmission line routes; however, these areas would be classified as rural and would have ambient noise levels similar to Sites 2, 3, and 4. Wind, traffic, occasional airplanes, and recreational activities are the primary sources of noise. Noise sensitive areas include crucial winter range for pronghorn during winter, sage grouse leks during the breeding season, and occupied raptor nests (Section 3.2.2).

No specific data on odors are available for the KPPA. Odors present in the area would include the natural odors of vegetation and wildlife and man-caused odors associated with existing oil and gas wells, emissions from vehicles, and livestock concentration areas. Most odors are likely to be quickly dispersed by wind.

3.1.7 Electric and Magnetic Fields

In recent years, electric and magnetic fields (EMFs) have become a public health and safety concern as preliminary studies have demonstrated a possible connection between EMFs and certain diseases, although to date, a direct cause-and-effect relationship has not been determined [Frey 1993, Sacramento Municipal Utility District (SMUD) 1993, Public Utility Commission of Texas 1992]. Due to the lack of data on the biological effects of EMFs, no national standard for exposure level has been established whereby a proposed project would be classified as "safe" or a health risk. Some states have established electric or magnetic field standards. The State of Wyoming does not have standards for either.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances and equipment. Throughout a home, the electric field strength from wiring and appliances is typically less than 0.01 kilovolts per m (kV/m). However, fields of 0.1 kV/m and higher can be found very close to electrical appliances.

The average background magnetic field level measured in the center of rooms in 992 homes throughout the U.S. was 0.9 milligauss (mG) (Zanfanella 1993). In 15% of homes, the magnetic field level was greater than 2.1 mG. Fields very close to electrical appliances are much stronger than these levels, but appliance fields decrease in strength with distance very rapidly. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material, so power lines can be a major source of magnetic field exposure throughout a home located close to the line. Typical electric and magnetic field strengths for some BPA transmission lines are given in Table 3.7.

Existing power lines within the KPPA are the major producers of EMFs, but are extremely limited in extent. High voltage transmission lines within the KPPA are limited to two very short segments [<1 mi (1.6 km)], one which crosses the southern end of Arlington Peak adjacent to I-80, and another which crosses the northwestern corner of the Simpson Ridge area west of Hi Allen Ridge. There are no homes or businesses close enough to the proposed transmission corridor to experience magnetic or electric field exposures from the proposed new facilities.

More detailed information on the potential health effects of electric and magnetic fields can be found in two free BPA publications incorporated here by reference: *Electrical and Biological Effects of*

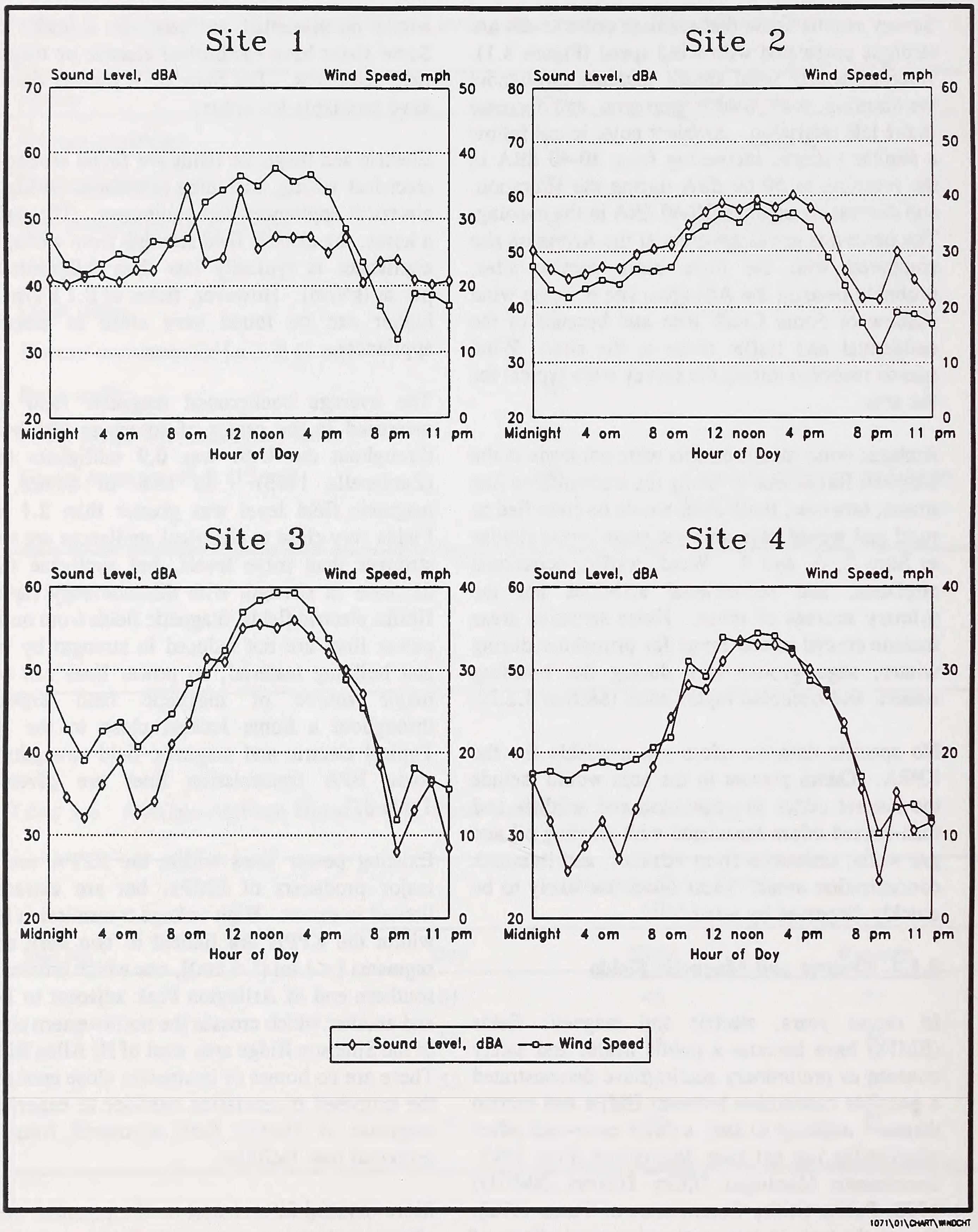


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Figure 3.1 Correlation Between Average Ambient Noise Levels and Wind Speed, Foote Creek Rim.

Table 3.7 Typical Electric and Magnetic Field Strengths of Transmission Lines.[1]

Transmission Line Type	Electric Field (kV/m)	Magnetic Field (mG) Maximum[2]	Magnetic Field (mG) Average[3]
115-kV			
Maximum on ROW	1.0	63	30
Edge of ROW	0.5	14	7
200 ft (61 m) from center ROW	<0.1	1	<1
230-kV			
Maximum on ROW	2.0	118	58
Edge of ROW	1.5	40	20
200 ft (61 m) from center ROW	<0.1	4	2
500-kV			
Maximum on ROW	7.0	183	87
Edge of ROW	3.0	62	30
200 ft (61 m) from center ROW	0.3	7	3

1 BPA study to characterize nearly 400 BPA transmission lines located in the Pacific Northwest (n.d.).
2 Under annual peak load conditions (occurs less than 1% of the time).
3 Under annual average loading conditions.

Transmission Lines: A Review (BPA 1993b) and *Electric Power Lines: Questions and Answers on Research Into Health Effects* (BPA 1994).

3.2 BIOLOGICAL RESOURCES

3.2.1 Vegetation

The KPPA is located in the 10 to 14 inch (25-5 cm) precipitation zone (BLM 1987:135). Vegetation on Foote Creek Rim and an adjacent 2-mi (3-km) buffer was mapped using aerial photographs, 7.5' topographic maps, and ground surveys. The Simpson Ridge area and the alternate transmission line routes were mapped using BLM soils maps (BLM 1994c) and corresponding range site descriptions [Soil Conservation Service (SCS) 1988], aerial photographs, and the GDRA RMP (BLM 1987:169-180). Vegetation maps were not available for approximately 5-7 mi (8-11 km) of the southern portions of the three transmission line routes. Additional vegetation mapping of the Simpson Ridge area and the selected transmission line route would be completed, if necessary, as part of a future POD prior to construction of future phases. Eleven major vegetation types occur within the KPPA. Refer to Table 3.8 for a list of dominant species within each vegetation type. Common and scientific names of plant species discussed in the following section are presented in Appendix C.

3.2.1.1 Plant Communities

Six vegetation types were identified on Foote Creek Rim and its associated 2-mi (3-km) buffer (Map 3.7) (Table 3.9). Nine vegetation types occur within the Simpson Ridge area and transmission line routes.

The mixed grass/sagebrush vegetation type occurs along the eastern and western slopes of Foote Creek Rim and occupies 3,070 ac (61%) of the Foote Creek Rim project area (Table 3.9). It also occurs along the three transmission line routes, occupying between 32 and 36 ac. Vegetation is composed of 30-80% grasses and grasslike species, 5-15% forbs, and 10-65% woody plants (BLM 1987:169-171).

Ground cover ranges from 10-45%, and the average annual production from rangeland in excellent condition ranges from 500-1,025 lbs/ac during years with normal precipitation (SCS 1988). In general, this vegetation type is supported by soils on nearly level to moderately steep uplands.

Vegetation on top of Foote Creek Rim is composed of a cushion plant community which occupies 1,300 ac (26%) of the Foote Creek Rim project area and 3-4 ac along all three transmission line routes. Small areas of this type may also occur as inclusions in the sagebrush and grassland types within the Simpson Ridge area. Cushion plants (i.e., low- growing forbs) dominate this community. Grasses (e.g., prairie Junegrass), forbs (e.g., fringed sage), and woody plants (e.g., black sagebrush) are common components of this vegetation type. Productivity and ground cover data were not available for this type. This vegetation type is supported by soils on nearly level to gently sloping terrace remnants.

Mountain shrub vegetation typically occurs in isolated patches on ridges with very shallow soils. This vegetation type occupies 420 ac (8%) of the Foote Creek Rim project area and 7,422 ac (14%) of the Simpson Ridge area. It is also found along all three transmission line routes, occupying 7-153 ac. Typically, this type is composed of 3% grasses and grasslike species, 5% forbs, and 92% woody species (BLM 1987:172-174). Ground cover ranges from approximately 10-20%, with an average production from rangelands in excellent condition of 450 lbs/ac during years with normal precipitation (SCS 1988). This vegetation type is supported by soils on nearly level to moderately steep uplands or soils on ridges, sideslopes, and rough broken lands.

Two types of woodlands, aspen and ponderosa pine, occur within the KPPA. Aspen woodlands are located on the eastern slope of Foote Creek Rim near Arlington and occupy 150 ac (3%) of the

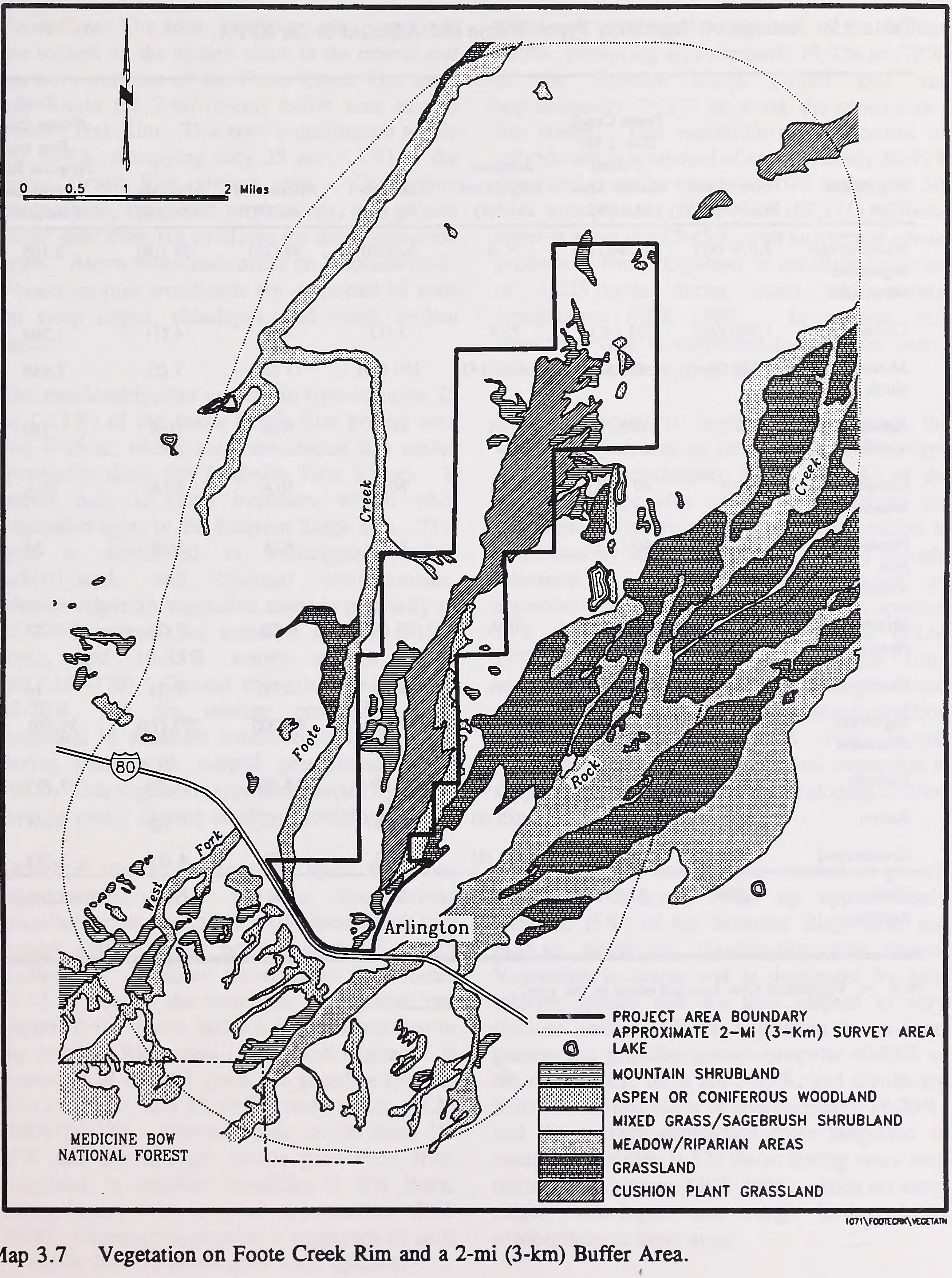
Table 3.8 Vegetation Types and Common Species Within and Adjacent to the KPPA.

Vegetation Type	Percent of the KPPA[1]	Common Species: Woody Plants	Common Species: Forbs	Common Species: Grasses and Grasslike Species
Mixed-grassland/ sagebrush shrubland	5	Big sagebrush, black sagebrush, antelope bitterbrush, rabbitbrush, silver sagebrush, snowberry	Aster, beardtongue, biscuitroot, buckwheat, Indian paintbrush, milkvetch, pussy-toes, woody aster	Junegrass, needlegrass, sedges, western wheatgrass
Cushion plant	3	Rabbitbrush, silver sagebrush	Cushion plants, fringed sage, pussy-toes, stemmy goldenweed	Bluebunch wheatgrass, Junegrass, western wheatgrass
Mountain shrub	13	Big sagebrush, common chokecherry, barberry, mountain mahogany, rabbitbrush, *Ribes*, serviceberry, silver sagebrush, snowberry	Arrowleaf balsamroot, beardtongue, fringed sage, buckwheat, lupine, violet, yarrow	Bluebunch wheatgrass, bluegrass, Idaho fescue, Junegrass, mountain brome, needlegrass, Sandberg bluegrass, sedges, timothy, western wheatgrass, wildrye
Aspen woodland	<1	Antelope bitterbrush, common chokecherry, elderberry, Oregon grape, quaking aspen, *Ribes*, snowberry, serviceberry, silver sagebrush	Arrowleaf balsamroot, bracken fern, columbine, fringed sage, geranium, hound's tongue, lupine, yarrow	Bluegrass, brome, Junegrass, needlegrass, sedges, timothy, western wheatgrass
Forested upland	0	Big sagebrush, Engelmann spruce, common juniper, Douglas-fir, Oregon grape, quaking aspen, serviceberry, snowberry, subalpine fir, Wood's rose	Columbine, geranium, yarrow	Bluegrass, needlegrass, sedges, timothy
Ponderosa pine woodland	<1	Big sagebrush, ponderosa pine, snowberry	Arnica, aster, balsamroot, mountain pea, vetch, yarrow, wintergreen	Sedges, western wheatgrass
Meadow/riparian	<1	Big sagebrush, dogwood, licorice, narrowleaf cottonwood, quaking aspen, rabbitbrush, raspberry, *Ribes*, saltbush, silver sagebrush, willow, Wood's rose	Canada thistle, cattail, columbine, common dandelion, curlycup gumweed, geranium, goldenaster, horsetail, lupine, plantain, red clover	Bluegrass, foxtail barley, Junegrass, needlegrass, ricegrass, rushes, sedges, spikerush, timothy, western wheatgrass, wildrye

Table 3.8 (Continued)

Vegetation Type	Percent of the KPPA[1]	Common Species: Woody Plants	Forbs	Grasses and Grasslike Species
Grassland	<1	Big sagebrush, eastern cottonwood, rabbitbrush	Canada thistle, cattail, common dandelion, curlycup gumweed, fringed sage, golden aster, horsetail, lupine, plantain, red clover, showy milkweed	Bluegrass, foxtail barley, Junegrass, rushes, smooth brome, timothy, western wheatgrass
Sagebrush shrubland	64	Basin big sagebrush, black sagebrush, Douglas rabbitbrush, rubber rabbitbrush, Wyoming big sagebrush	Aster, buckwheat, lupine, phlox, pussy-toes	Bluebunch wheatgrass, Indian ricegrass, needle-and-thread grass, Sandberg bluegrass, thickspike wheatgrass, western wheatgrass
Saltbush	6	Birdfoot sagebrush, bud sagebrush, Gardner's saltbush, Nuttall's saltbush	Aster, beardtongue, biscuitroot, buckwheat, onion, phlox	Bluebunch wheatgrass, bottlebrush squirreltail, Indian ricegrass, Sandberg bluegrass, western wheatgrass
Barren	5	Birdfoot sagebrush, Gardner's saltbush, low rabbitbrush, winterfat	Aster, balsamroot, beardtongue, pussy-toes, stonecrop, yarrow	Bluebunch wheatgrass, bottlebrush squirreltail, Indian ricegrass, needle-and-thread grass, western wheatgrass
Greasewood	3	Big sagebrush, black greasewood, bud sagebrush, Gardner's saltbush, winterfat	Biscuitroot, dock, phlox, plains prickly pear, sea blite	Alkali sacaton, Indian ricegrass, Sandberg bluegrass, thickspike wheatgrass, western wheatgrass

[1] Includes the Foote Creek Rim and Simpson Ridge areas, and Alternate 3 only.



Map 3.7 Vegetation on Foote Creek Rim and a 2-mi (3-km) Buffer Area.

Table 3.9 Acreage of Vegetation Types Within and Adjacent to the KPPA.

Vegetation Type	Foote Creek Rim Ac (%)	Foote Creek Rim 2-Mi (3-Km) Buffer Area Ac (%)	Simpson Ridge Area Ac (%)	Alternate 1 Ac (%)	Alternate 2 Ac (%)	Alternate 3 Ac (%)	Total (Foote Creek Rim and Simpson Ridge Areas and Alternate 3)
Mixed-grass/ sagebrush shrubland	3,070 (61)	27,784 (74)	N/A	32 (10)	36 (12)	35 (10)	3,105
Cushion plant	1,300 (26)	231 (<1)	N/A	3 (1)	3 (1)	4 (1)	1,304
Mountain shrub	420 (8)	490 (1)	7,422 (14)	150 (50)	77 (26)	7 (2)	7,849
Aspen woodland	150 (3)	552 (1)	N/A	N/A	N/A	N/A	150
Coniferous woodland	N/A	40 (<1)	N/A	N/A	N/A	N/A	N/A
Ponderosa pine woodland	25 (<1)	40 (<1)	N/A	N/A	N/A	N/A	25
Meadow/ riparian	25 (<1)	5,704 (15)	N/A	16 (5)	6 (2)	7 (2)	32
Grassland	10 (<1)	2,930 (8)	N/A	6 (2)	12 (4)	4 (1)	14
Sagebrush shrubland	N/A	N/A	39,324 (72)	79 (25)	94 (32)	277 (78)	39,601
Saltbush	N/A	N/A	3,526 (6)	12 (4)	18 (6)	11 (3)	3,537
Barren	N/A	N/A	3,042 (5)	6 (2)	44 (15)	7 (2)	3,049
Greasewood	N/A	N/A	1,579 (3)	3 (1)	6 (2)	4 (1)	1,583
Total Acreage	5,000	37,771	54,893	310	296	356	60,249

N/A = Vegetation type does not occur in the area.

Foote Creek Rim area. Ponderosa pine woodlands are located on the eastern slope in the central and northern portions of the Foote Creek Rim area, and within the 2-mi (3-km) buffer area east of Foote Creek Rim. This type is uncommon within the KPPA, occupying only 25 ac (<1%) of the Foote Creek Rim project area. Community composition, rangeland productivity, and ground cover data were not available for these woodland types. Aspen woodlands occur on landslide soils. Ponderosa pine woodlands are supported by soils on steep ridges, sideslopes, and rough broken lands.

The meadow/riparian vegetation type occupies 25 ac (<1%) of the Foote Creek Rim project area and 6-16 ac within the transmission line routes (primarily along the Medicine Bow River). It occurs only as small inclusions within other vegetation types in the Simpson Ridge area. This type is distributed in subirrigated, saline subirrigated, and lowland environments. Meadow/riparian vegetation consists primarily of 45-100% grasses and grasslike species, 5-10% forbs, and 10-35% woody species (BLM 1987:169-170). Ground cover is approximately 45-70%, and the average production from rangeland in excellent condition is 3,500 lbs/ac during years with normal precipitation (SCS 1988). This vegetation type is supported by nearly level to gently sloping alkaline alluvial soils.

Grassland vegetation occurs as small inclusions (approximately 10 ac) in the mixed grass/sagebrush vegetation in the Foote Creek Rim project area. It also occurs along the eastern portions of the three transmission line routes (4-12 ac), but to the west, this type grades into sagebrush shrubland, and it is not a distinct type in the Simpson Ridge area. Grassland vegetation is composed of 65-80% grass and grasslike species, 10-15% forbs, and 10-20% woody plants (BLM 1987:167-170). Ground cover ranges from 15-25% and the average annual production from rangeland in excellent condition is 500 lbs/ac during years with normal precipitation (SCS 1988). Grassland vegetation is supported by soils on nearly level to moderately steep uplands.

Sagebrush shrubland is abundant in the western KPPA, occupying approximately 39,324 ac (72%) of the Simpson Ridge project area and approximately 79-277 ac along the transmission line routes. This vegetation type is located on uplands and is composed of approximately 30-40% grass and grasslike species, 5-10% forbs, and 50-65% woody plants (BLM 1987:169,171). Ground cover is generally 15-45%, with an average annual production from rangeland in excellent condition of 1,025 lbs/ac during years with normal precipitation (SCS 1988). In general, this vegetation type is supported by soils on nearly level to moderately steep uplands.

Saltbush vegetation is located throughout the western project area on saline uplands. This type comprises approximately 3,526 ac (6%) of the Simpson Ridge area and 11-18 ac along the transmission line routes. Saltbush vegetation is dominated by species with high salt and drought tolerances. Vegetation is composed of approximately 20% grass and grasslike species, 10% forbs, and 70% woody plants (BLM 1987:171,174). Ground cover ranges from approximately 15-25% and the average annual production from rangelands in excellent condition is 500 lbs/ac during years with normal precipitation (SCS 1988). Saltbrush vegetation is supported by nearly level to gently sloping alkaline alluvial soils.

Barren or nearly barren areas, located on gravels and shale outcrops, make up approximately 3,042 ac (6%) of the Simpson Ridge area and 6-44 ac along the transmission line routes. Vegetation is sparse and is dominated by salt-tolerant species that are also adapted to very shallow soils. Where vegetation is present, grasses and grasslike species comprise 40-95% of the community, forbs are 5-10%, and shrubs are 5-30%. Ground cover is approximately 10-20%, and the average production from rangeland in excellent condition is 375 lbs/ac during years with normal precipitation (SCS 1988). Soils on steep ridges, sideslopes, and rough broken lands predominate in these areas.

The greasewood shrubland vegetation type occupies approximately 1,579 ac (3%) of the Simpson Ridge project area and 3-6 ac along the transmission line routes. This type occurs in saline, low-lying areas along stream valleys. Greasewood shrubland vegetation is composed of approximately 20% grasses and grasslike species, 10% forbs, and 70% woody plants (BLM 1987:171,174). Ground cover averages approximately 25-45% and the average production from rangelands in excellent condition is 1,800 lbs/ac during years with normal precipitation (SCS 1988). This vegetation type is supported by nearly level to gently sloping alkaline alluvial soils.

The 2-mi (3-km) buffer area around Foote Creek Rim is dominated by the mixed grass/sagebrush vegetation type. Toward the west the mixed grass/sagebrush vegetation type grades into sagebrush shrubland, which occupies the majority of the area west of Foote Creek Rim. The Medicine Bow National Forest is located within the 2-mi (3-km) buffer area south of Foote Creek Rim. Lodgepole pine, Englemann spruce, and Douglas-fir are the dominant tree species in the forest. Meadow/riparian areas associated with Rock Creek and Foote Creek are also located within the 2-mi (3-km) buffer. Soils within the Medicine Bow National Forest were not examined for this EIS.

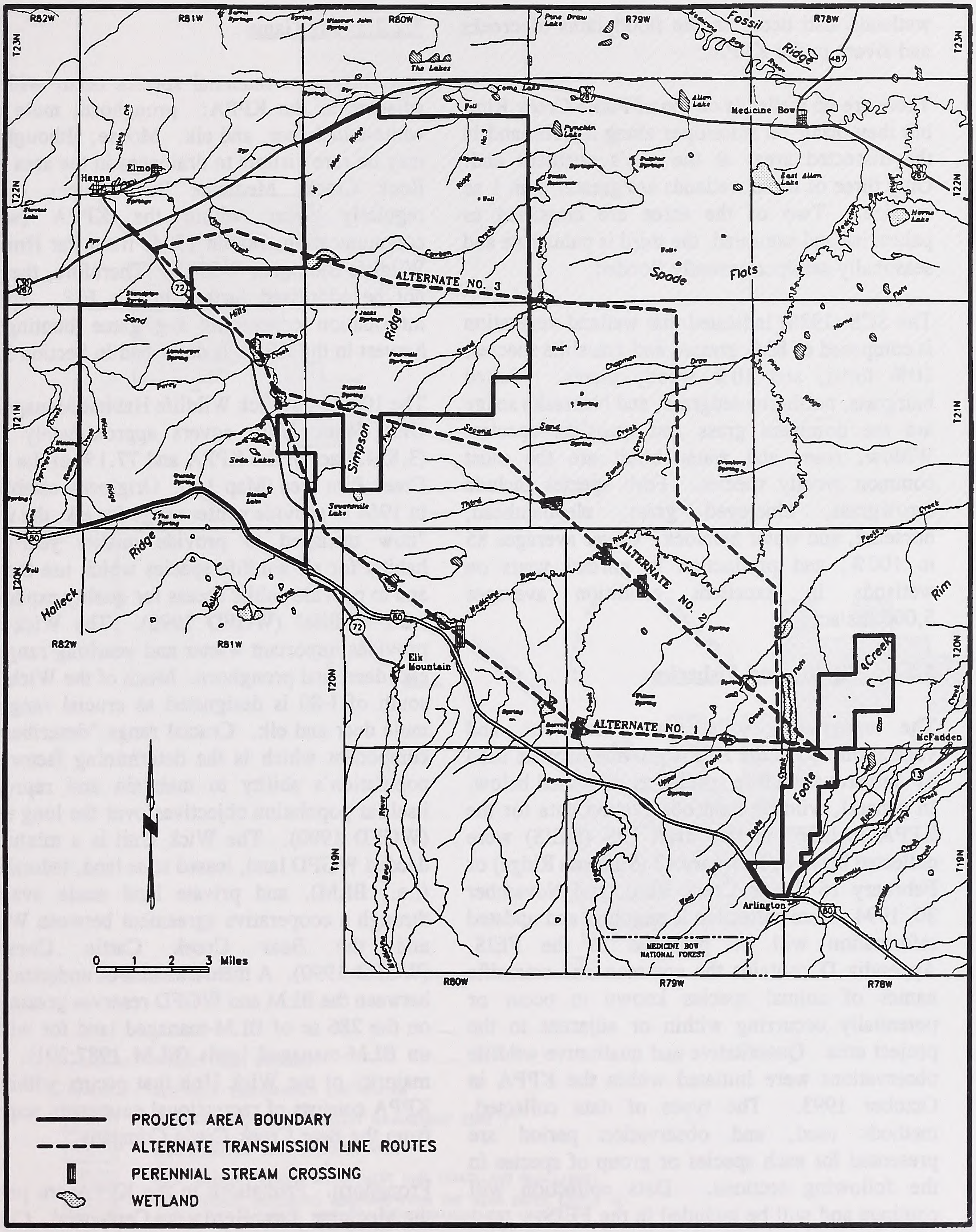
3.2.1.2 Wetlands

Wetlands, which are protected under Section 404 of the Clean Water Act (33 C.F.R. 1251 et seq.) and Executive Order No. 11990, are considered sensitive and valuable resources. Maps produced for the National Wetlands Inventory (NWI) (USFWS 1991) were examined to identify potential wetlands in the project area. Formal wetland delineations have not been performed, and thus, the following discussion addresses potential wetland areas only, based on review of the NWI maps. Wetlands would be evaluated on a site-specific basis for all proposed turbine locations, roads, and transmission routes during the POD process, and all necessary permits would be obtained prior to disturbing any wetlands. Wetlands would be avoided where feasible, or mitigated to ensure no net loss of wetlands.

There are more than 325 potential wetlands (approximately 430 ac) scattered throughout the project area. Map 3.8 shows the approximate locations of wetlands greater than 1 ac in size. Wetlands occur in a wide variety of topographic positions, but are most commonly associated with ephemeral drainages, impoundments, and major stream channels. In addition, there are several playas (ephemeral ponds with no external drainage), lakes, reservoirs, springs, and excavated pits in the area that are classified as wetlands on the NWI maps. Most wetlands within the KPPA are classified as temporarily, seasonally, or semipermanently flooded.

The largest wetland/floodplain area occurs adjacent to the Soda Lakes in the Simpson Ridge area, where approximately 160 ac of palustrine wetlands occur. Other lakes, ponded areas, and reservoirs are scattered throughout the project area. The larger water bodies and some playas typically support wetlands classified as palustrine. Many of these wetlands are the result of dikes or impoundments.

The floodplains of rivers and creeks within the area contain numerous palustrine and riverine wetlands. In the floodplain of the Medicine Bow River, especially in the southern portion of the KPPA, numerous palustrine wetlands that are temporarily or seasonally flooded spread out for 0.5 mi (0.8 km) from the main river channel. Alternate 1 crosses approximately 1.0 mi (1.6 km) of potential wetlands along the Medicine Bow River. The other two alternate routes cross the Medicine Bow River in places where the floodplain is narrower. Most of the creeks (i.e., Foote Creek, Wagonhound Creek, Percy Creek, Carbon Creek, First Sand Creek, Kinney Creek) within the KPPA area contain numerous small impoundments behind which wetlands have formed. The larger impounded areas (greater than 1 ac in size) are predominantly classified as palustrine wetlands. Linear palustrine and riverine



Map 3.8 Locations of Wetlands Larger Than One Acre.

wetlands also occur in the floodplains of creeks and rivers in the KPPA.

There are no wetlands on top of Foote Creek Rim, but they occur on sideslopes along the rim and in the dissected areas at the rim's northern end. Only three of these wetlands are greater than 1 ac in size. Two of the three are classified as palustrine and saturated, the third is palustrine and seasonally-semipermanently flooded.

The SCS (1988) indicated that wetland vegetation is composed of 80% grasses and grasslike species, 10% forbs, and 10% woody plants. Tufted hairgrass, northern reedgrass, and Nebraska sedge are the dominant grass and grasslike species. Willow, rose, and water birch are the most common woody species. Forb species include arrowgrass, blue-eyed grass, elephanthead, horsetail, and water hemlock. Cover averages 85 to 100%, and production in normal years on wetlands in excellent condition averages 5,000 lbs/ac.

3.2.2 Wildlife and Fisheries

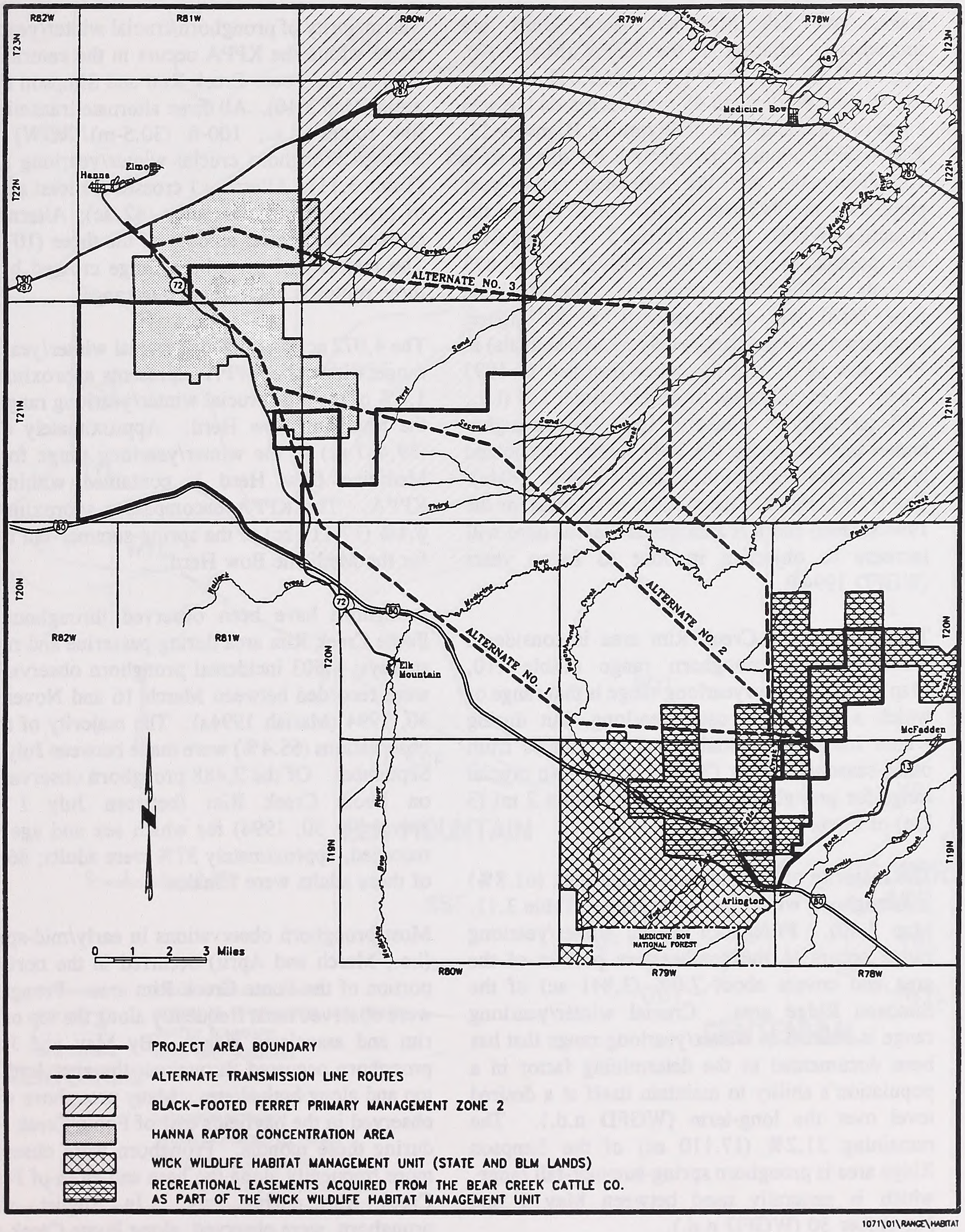
The topography, soils, water resources, and vegetation within the KPPA provide habitats used by numerous wildlife species as discussed below. In general, wildlife field observation data for the KPPA included in this draft EIS (DEIS) were collected between February 13 (Simpson Ridge) or February 16 (Foote Creek Rim), and November 30, 1994. Data collection is ongoing, and updated information will be provided in the FEIS. Appendix D contains the common and scientific names of animal species known to occur or potentially occurring within or adjacent to the project area. Quantitative and qualitative wildlife observations were initiated within the KPPA in October 1993. The types of data collected, methods used, and observation period are presented for each species or group of species in the following sections. Data collection will continue and will be included in the FEIS.

3.2.2.1 Big Game

Four big game mammal species occur within or adjacent to the KPPA: pronghorn, mule deer, white-tailed deer, and elk. Moose, although they may be rare visitors to drainages in the area (e.g., Rock Creek, Medicine Bow River), do not regularly occur within the KPPA (written communication, March 1994, from Pat Hnilicka, Wildlife Biologist, WGFD). Therefore, they will not be addressed further in this EIS. Specific information concerning big game hunting and harvest in the KPPA is described in Section 3.5.4.

The 10,344-ac Wick Wildlife Habitat Management Unit (Wick Unit) covers approximately 6.4% (3,854.4 ac) of the KPPA and 77.1% of the Foote Creek Rim area (Map 3.9). Originally established in 1964 to provide winter range for elk, the unit is "now managed to provide quality year-round habitat for all wildlife species which use the area and to provide public access for quality experience with wildlife" (WGFD 1990). The Wick Unit provides important winter and yearlong range for elk, deer, and pronghorn. Much of the Wick Unit south of I-80 is designated as crucial range for mule deer and elk. Crucial range "describes that component which is the determining factor in a population's ability to maintain and reproduce itself at population objectives over the long term" (WGFD 1990). The Wick Unit is a mixture of deeded WGFD land, leased state land, federal land (i.e., BLM), and private land made available through a cooperative agreement between WGFD and the Bear Creek Cattle Company (WGFD 1990). A memorandum of understanding between the BLM and WGFD reserves grazing use on the 286 ac of BLM-managed land for wildlife on BLM-managed lands (BLM 1987:201). The majority of the Wick Unit that occurs within the KPPA consists of recreational easements acquired from the Bear Creek Cattle Company.

Pronghorn. Pronghorn in the KPPA are part of the Medicine Bow Herd; the Centennial, Cooper



Map 3.9 State and Federal Wildlife Management Areas.

Lake, and Elk Mountain Herd Units are immediately adjacent to the KPPA (Map 3.10). The Medicine Bow Herd Unit includes Hunt Areas 41, 42, and 46 through 48, and occurs on the area north of I-80, and west of Wyoming Highway 13. The WGFD population objective for this herd is 45,000 animals, and the estimated end-of-year population in 1993 was 25,761, or 57.2% of the objective (WGFD 1994a) (Table 3.10). The five-year population average (1989-1993) was 34,873 animals, or 77.5% of objective. The Medicine Bow Herd was most recently at its highest population level (approximately 39,000 animals) in 1990 and 1991, and has since declined to 1993 levels. A combination of severe winter kill (i.e., 30% mortality in winter of 1992-93) and higher hunter harvest during the 1993 season contributed to the recent population decline (WGFD 1994a). The WGFD reduced the number of licenses for the 1994 season, and it is anticipated that the herd will increase to objective in four to seven years (WGFD 1994a).

The entire Foote Creek Rim area is considered winter/yearlong pronghorn range (Table 3.10, Map 3.10). Winter/yearlong range is that range of which a portion is used yearlong, but during winter has a substantial influx of animals from other seasonal ranges (WGFD n.d.). No crucial range for pronghorn occurs on or within 2 mi (3 km) of Foote Creek Rim.

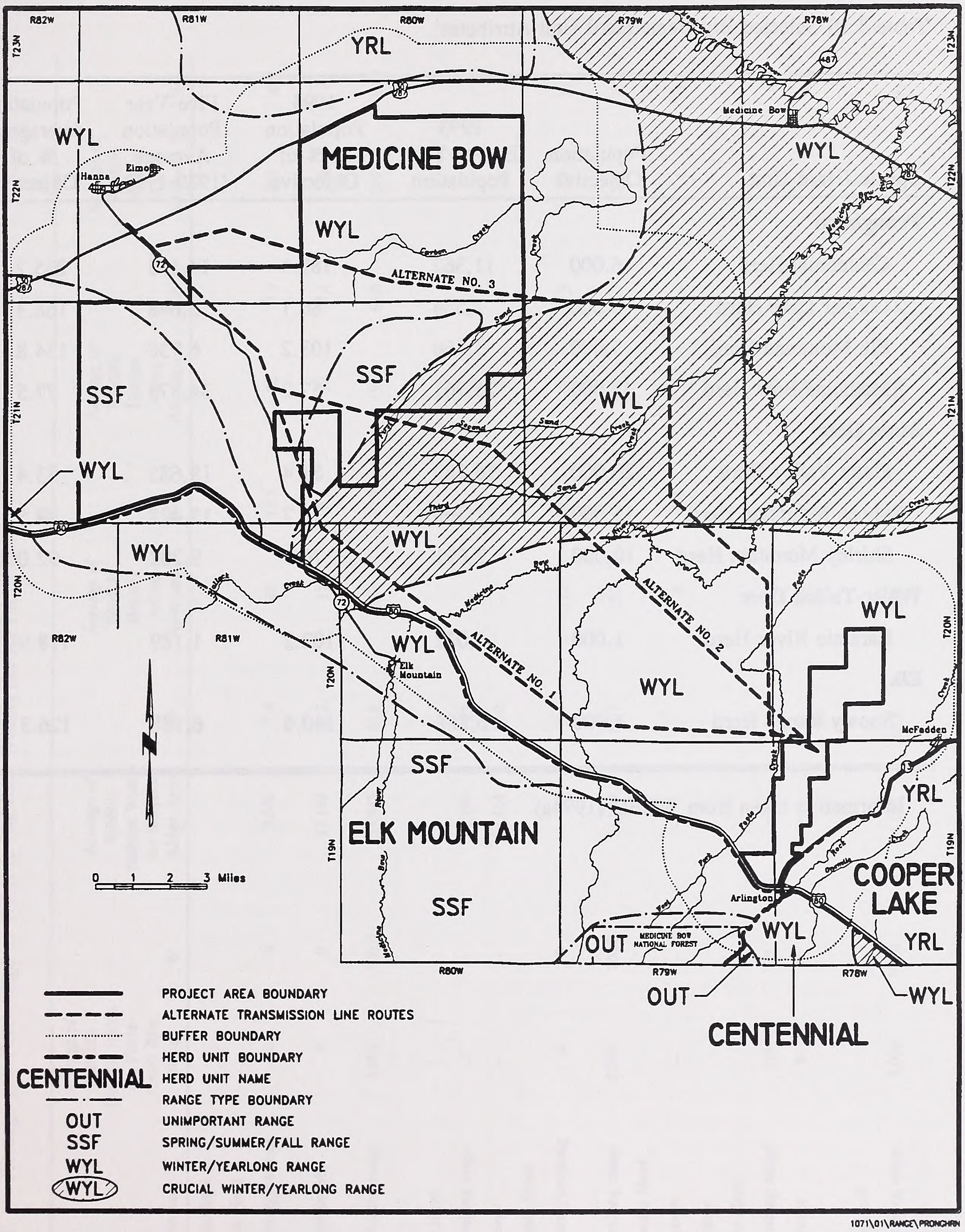
The majority of the Simpson Ridge area (61.8%) is pronghorn winter/yearlong range (Table 3.11, Map 3.10). Pronghorn crucial winter/yearlong range occurs in the southeastern portion of the area and covers about 7.0% (3,841 ac) of the Simpson Ridge area. Crucial winter/yearlong range is defined as winter/yearlong range that has been documented as the determining factor in a population's ability to maintain itself at a desired level over the long-term (WGFD n.d.). The remaining 31.2% (17,110 ac) of the Simpson Ridge area is pronghorn spring-summer-fall range, which is generally used between May 1 and November 30 (WGFD n.d.).

The majority of pronghorn crucial winter/yearlong range within the KPPA occurs in the central area between the Foote Creek Rim and Simpson Ridge areas (Map 3.10). All three alternate transmission line routes [i.e., 100-ft (30.5-m) ROW] pass through pronghorn crucial winter/yearlong range (Table 3.11). Alternate 1 crosses the least amount of pronghorn crucial range (42 ac); Alternate 3 crosses the greatest amount of the three (107 ac). The majority of pronghorn range crossed by the three routes is winter/yearlong range.

The 4,072 ac of pronghorn crucial winter/yearlong range within the KPPA represents approximately 1.8% of the total crucial winter/yearlong range for the Medicine Bow Herd. Approximately 6.5% (39,437 ac) of the winter/yearlong range for the Medicine Bow Herd is contained within the KPPA. The KPPA encompasses approximately 6.1% (17,111 ac) of the spring-summer-fall range for the Medicine Bow Herd.

Pronghorn have been observed throughout the Foote Creek Rim area during passerine and raptor surveys; 4,503 incidental pronghorn observations were recorded between March 16 and November 30, 1994 (Mariah 1994a). The majority of these observations (65.4%) were made between July and September. Of the 2,488 pronghorn observations on Foote Creek Rim (between July 1 and November 30, 1994) for which sex and age was recorded, approximately 57% were adults; 86.8% of these adults were females.

Most pronghorn observations in early/mid-spring (i.e., March and April) occurred in the northern portion of the Foote Creek Rim area. Pronghorn were observed most frequently along the top of the rim and associated ridges. By May and June, pronghorn occurred throughout the rim, both on top and along both slopes. Many pronghorn were observed in the hayfields east of Foote Creek Rim during these months. Pronghorn were observed more frequently along the base and sides of Foote Creek Rim during July. In August, most pronghorn were observed along Foote Creek and



Map 3.10 Pronghorn Herd Units and Range Types.

Table 3.10 Selected Big Game Herd Unit Attributes[1].

Species/Herd Unit	Population Objective	1993 End-of-Year Population	1993 Population as % of Objective	Five-Year Population Average (1989-1993)	Population Average as % of Objective
Pronghorn					
Centennial Herd	6,000	11,362	189.4	14,113	235.2
Cooper Lake Herd	3,000	2,584	86.1	5,048	168.3
Elk Mountain Herd	5,000	5,160	103.2	6,738	134.8
Medicine Bow Herd	45,000	25,761	57.2	34,873	77.5
Mule Deer					
Platte Valley Herd	20,000	16,289	81.4	18,685	93.4
Sheep Mountain Herd	15,000	11,360	75.7	13,428	89.5
Shirley Mountain Herd	10,000	7,091	70.9	9,202	92.0
White-Tailed Deer					
Laramie River Herd	1,000	1,022	102.2	1,189	118.9
Elk					
Snowy Range Herd	4,900	6,888	140.6	6,188	126.3

1 Information taken from WGFD (1994a).

Table 3.11 Acreage and Percentage of Wildlife Habitats Within the KPPA, 1994.

Wildlife Resources	Acreage of Wildlife Habitat within the Foote Creek Rim Area	%[1]	Acreage of Wildlife Habitat Within the Simpson Ridge Area	%[1]	Acreage of Wildlife Habitat Along Alternate 1	%[1]	Acreage of Wildlife Habitat Along Alternate 2	%[1]	Acreage of Wildlife Habitat Along Alternate 3	%[1]
Pronghorn antelope										
Medicine Bow Herd										
Crucial winter/yearlong range	0	0	3,841	7.0	42	13.5	82	27.7	107	30.1
Spring-summer-fall range	0	0	17,110	31.2	11	3.5	22	7.4	0	0
Winter/yearlong range	5,000	100.0	33,943	61.8	257	82.9	192	65.0	249	69.9
Mule Deer										
Platte Valley Herd										
Winter/yearlong range	–[2]	–	7,299	13.3	–	–	–	–	–	–
Yearlong range	–	–	10,414	19.0	–	–	–	–	–	–
Sheep Mountain Herd										
Crucial winter/yearlong range	0	0	0	0	112	36.1	66	22.3	83	23.3
Winter/yearlong range	5,000	100.0	37,179	67.7	195	62.9	227	76.7	270	75.8
Shirley Mountain Herd										
Yearlong range	–	–	–	–	4	1.3	4	1.4	4	1.1
White-tailed deer										
Laramie River Herd										
Winter/yearlong range	149	3.0	0	0	0	0	0	0	0	0
Yearlong range	0	0	0	0	23	7.4	28	9.5	30	8.4
Elk										
Snowy Range Herd										
Winter/yearlong range	5,000	100.0	36,147	65.8	308	99.4	293	99.0	354	99.4

Table 3.11 (Continued)

Wildlife Resources	Acreage of Wildlife Habitat within the Foote Creek Rim Area	%[1]	Acreage of Wildlife Habitat Within the Simpson Ridge Area	%[1]	Acreage of Wildlife Habitat Along Alternate 1	%[1]	Acreage of Wildlife Habitat Along Alternate 2	%[1]	Acreage of Wildlife Habitat Along Alternate 3	%[1]
Raptors										
Potential habitat[3]	5,000	100.0	54,893	100.0	310	100.0	296	100.0	356	100.0
Nesting buffers[4]	2,771	55.4	36,170	65.9	211	68.1	177	59.8	229	64.3
Sage Grouse										
Probable nesting habitat[5]	98	2.0	47,549	86.6	182	58.7	195	65.9	212	59.6
Potential breeding habitat[6]	0	0	3,110	5.7	10	3.2	5	1.7	9	2.5

[1] % = Percentage of total specified area (i.e., Foote Creek Rim area, Simpson Ridge area, Alternates 1-3).
[2] -- = Herd unit not present within specified portion of project area.
[3] Assumes that the entire KPPA is suitable raptor habitat.
[4] Areas within 0.75 mi of all known raptor nests on or adjacent to the KPPA.
[5] Areas within 2.0 mi of known lek sites on or adjacent to the KPPA.
[6] Areas within 0.25 mi of known lek sites on or adjacent to the KPPA.

its tributaries on the western side of the rim, in the hayfields at the base of the rim on the eastern side, and on the northern and western slopes of Arlington Peak; it is likely that these areas were the last to contain green and/or palatable vegetation. From September through November, pronghorn were again observed along the top of the rim and the western slope. During the hunting season (i.e., late September to late October), pronghorn moved into the less accessible areas at the northern end of the rim; some continued to frequent the top and western slope.

Pronghorn have been observed throughout those portions of Simpson Ridge surveyed for passerines and raptors (Mariah 1994a). Six hundred and eighteen pronghorn observations were recorded in the Simpson Ridge area between February 13 and November 30, 1994 (i.e., approximately 22 survey days). Of the 448 observations for which age and sex information was recorded, 278 observations (62.1%) were of adult females, 52 (11.6%) were of adult males, and 118 (26.3%) were fawns.

No specific seasonal movement patterns for pronghorn within the KPPA have been delineated by the WGFD. The timing of seasonal movements and the extent to which crucial winter/yearlong range is used are dependent on weather and snow depth (Yoakum 1978, Guenzel 1986, Deblinger 1988). It is likely that pronghorn move to the crucial winter/yearlong range in the central KPPA during severe winters and during periods of severe weather within otherwise normal winters. Ryder and Irwin (1987) determined that winter habitat selection by pronghorn in southcentral Wyoming was dependent upon the density and height of big sagebrush and black greasewood in protected terrain. High pronghorn densities occurred: 1) in habitats containing an average of 0.5 big sagebrush per 10 ft^2 (per m^2) on northwestern ridges and benches and 2) in those habitats containing black greasewood mixed with big sagebrush in stands averaging 0.4 plants per 10 ft^2 (per m^2) in draws and lowland flats. The sagebrush shrubland and greasewood vegetation types cover much of the western KPPA, including most of the Simpson Ridge area (Table 3.9), and likely provide areas of appropriate winter habitat for pronghorn. Pronghorn may use habitats with less dense and lower sagebrush (e.g., top and slopes of Foote Creek Rim) only when snow depths prevent foraging in more protected areas; however, prolonged use of these windblown sites may stress pronghorn (Ryder and Irwin 1987). Pronghorn collared as part of a seasonal movement study for an earlier wind turbine project immediately north of the KPPA moved seasonally within the immediate area of the Medicine Bow River (Yeo et al. 1984). Some pronghorn also moved east into the Foote Creek drainage during the winter months and returned again to the Medicine Bow River in spring. Pronghorn tended to make circular movements through the northern and central portions of the KPPA, selecting habitats based on weather and vegetative structure (Yeo et al. 1984).

The majority of roads within the KPPA are unimproved two-tracks that are only occasionally used by landowners or, seasonally, by hunters. It is unlikely that these unimproved roads impede pronghorn movement within the KPPA. Two improved roads, State Highway 72 (paved) and a county road (gravel), traverse the KPPA from north to south; it is possible that these roads occasionally limit pronghorn movement due to periods of heavy traffic or, during the winter, deep snow in adjacent ditches (Bruns 1977).

Fences can impede pronghorn movement (Autenrieth 1983, Deblinger 1988). Deep snow and poor fence design (e.g., low bottom wire, sheep mesh), in combination, have been reported as significant sources of winter mortality (Yoakum 1978, Deblinger 1988). The fenced ROW along State Highway 72, although passable for most of the year, may impede pronghorn during periods of heavy snowfall in the winter. Some fences within the KPPA likely impede local and seasonal movements of pronghorn; however, no specific problem fences have been reported by the BLM or WGFD.

Mule Deer. Mule deer in the KPPA are part of three herd units: the Platte Valley, Sheep

Mountain, and Shirley Mountain Herds (Map 3.11).

The Sheep Mountain Herd occurs on a majority of the KPPA, including all of the Foote Creek Rim area, more than half of the Simpson Ridge area, and in the area between Foote Creek Rim and Simpson Ridge. This herd unit contains Hunt Areas 61 and 74 through 77 (WGFD 1994a). The WGFD population objective for the Sheep Mountain Herd is 15,000 animals, and the estimated end-of-year population in 1993 was 11,360 animals, or 75.7% of objective (Table 3.10). The five-year population average (1989-1993) was 13,428 animals, or 89.5% of objective. Population estimates for the Sheep Mountain Herd increased from 1986 to 1992, then declined to the 1993 level (WGFD 1994a). Reasons for the decline included high mortality during the winter of 1992-93 and the 1993 harvest level. A conservative hunting season in 1994 is expected to result in a population increase of approximately 17% over the 1993 estimate (WGFD 1994a).

The Platte Valley Herd occurs on 29% (17,714 ac) of the KPPA, exclusively in the western portion of the Simpson Ridge area (Map 3.11). Hunt Areas within the Platte Valley Herd are 78 through 81, 83, and 161. The WGFD population objective for the herd is 20,000 mule deer; the estimated 1993 end-of-year population for the herd was 81.4% of objective, or 16,289 animals. The five-year population average (1989-1993) for the herd was 18,685 deer, or 93.4% of objective. The population trend for the Platte Valley Herd between 1989 and 1993 was similar to that for the Sheep Mountain Herd; the 1994 population is anticipated to be slightly more than 96% of objective (i.e., 19,242 deer) (WGFD 1994a).

The Shirley Mountain Herd is located immediately north of Highway 30 and covers the northernmost 4.9 ac of the three transmission line routes near Hanna (Map 3.11). Population attributes of this herd are described in Table 3.10. The Shirley Mountain Herd peaked in 1991, at approximately 11,000 animals, and declined in 1992 and 1993 (WGFD 1994a). The WGFD anticipates that the population of this herd will increase to approximately 85% of objective (i.e., 8,537 deer) in 1994.

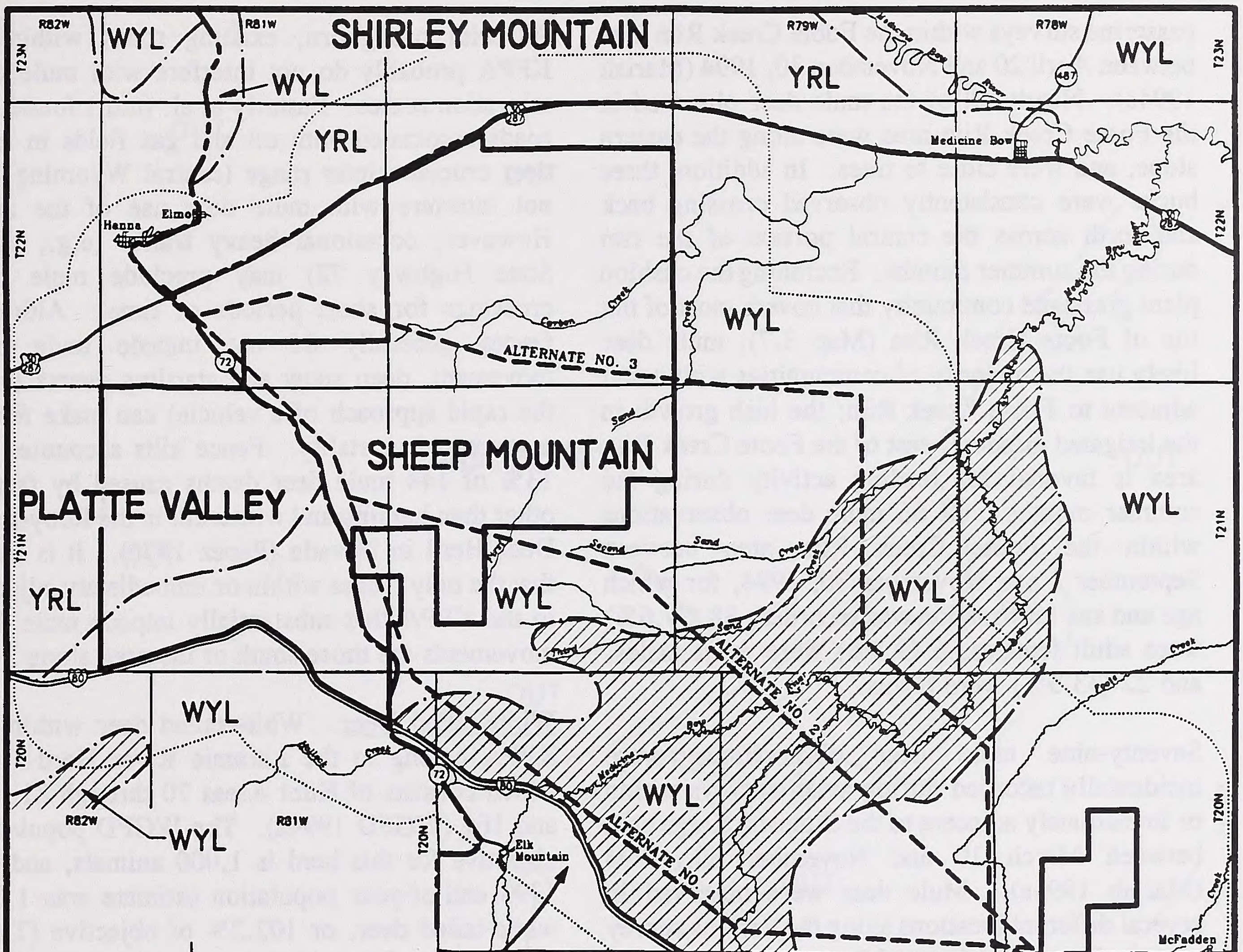
The Sheep Mountain Herd covers approximately 71% (42,890 ac) of the KPPA. All of the Foote Creek Rim area (5,000 ac) and 68% (37,179 ac) of the Simpson Ridge area are winter/yearlong range for this herd (Map 3.11). The only mule deer crucial winter/yearlong range within the KPPA occurs between Foote Creek Rim and Simpson Ridge in dissected terrain associated with the Medicine Bow River. Oedekoven and Lindzey (1987) determined that mule deer in southwestern Wyoming tended to use sagebrush habitats at lower elevations in areas with the least snow depth and cover during winter. Mule deer generally avoid areas where snow depth is greater than 18 inches (0.5 m) (Gilbert et al. 1970).

All three transmission line routes cross crucial range, with acreage traversed ranging from 66 ac (Alternate 2) to 112 ac (Alternate 1).

The remainder of the Simpson Ridge area is within the Platte Valley Herd Unit, and is split between winter/yearlong range [7,299 ac (13%)] and yearlong range [10,414 ac (19%)]. Yearlong range is that which a population or a substantial portion of a population uses throughout the year (WGFD n.d.).

The 260 ac of mule deer crucial winter/yearlong range crossed by the three transmission line routes within the central portion of the KPPA represents approximately 0.2% of this range type for the Sheep Mountain Herd. About 6% of the winter/yearlong range for the Sheep Mountain Herd is located within the KPPA. The KPPA encompasses approximately 1% of the mule deer winter/yearlong range and about 5% of the yearlong range for the Platte River Herd. Virtually none (i.e., <0.1%) of the yearlong range for the Shirley Mountain Herd is located within the KPPA.

One hundred sixty-six observations of mule deer were incidentally recorded during raptor and



Map 3.11 Mule Deer Herd Units and Range Types.

passerine surveys within the Foote Creek Rim area between April 20 and November 30, 1994 (Mariah 1994a). Nearly all of the mule deer observed in the Foote Creek Rim area were along the eastern slope, and were close to trees. In addition, three bucks were consistently observed crossing back and forth across the central portion of the rim during the summer months. Excluding the cushion plant grassland community that covers most of the top of Foote Creek Rim (Map 3.7), mule deer likely use the majority of communities within and adjacent to Foote Creek Rim; the lush growth in the irrigated meadows east of the Foote Creek Rim area is favored for feeding activity during the summer months. Of 66 mule deer observations within the Foote Creek Rim area between September 1 and November 30, 1994, for which age and sex information was recorded, 38 (57.6%) were adult females, 6 (9.1%) were adult males, and 22 (33.3%) were fawns.

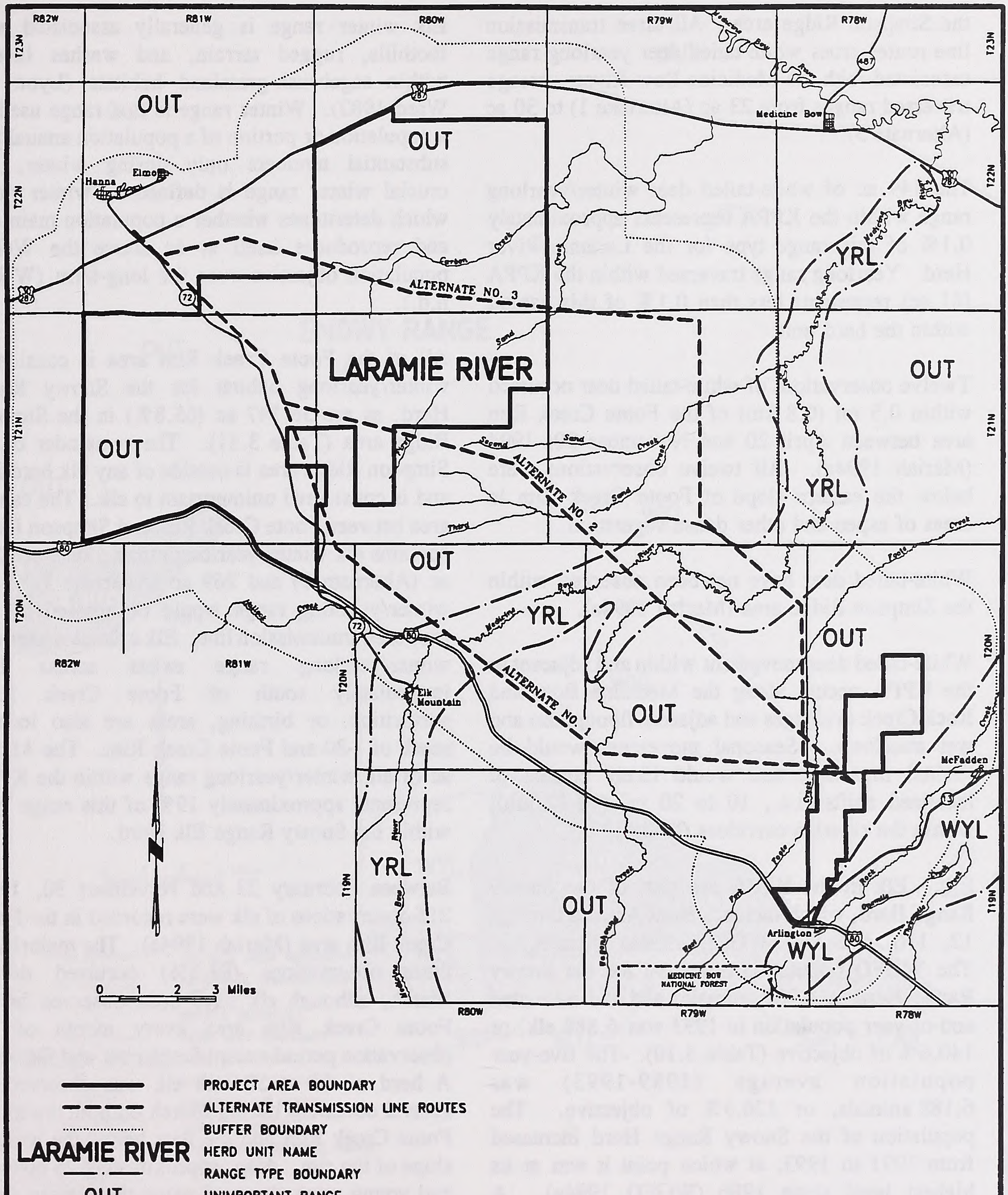
Seventy-nine mule deer observations were incidentally recorded during avian surveys within or immediately adjacent to the Simpson Ridge area between March 10 and November 30, 1994 (Mariah 1994a). Mule deer were observed in several different locations along the various survey routes, but were invariably seen in areas of relatively dense sagebrush cover and/or steep terrain; many were also observed close to stands of trees (e.g., aspen). Of 59 observations within the Simpson Ridge area between February 13 and November 30, 1994, 41 (69.5%) were adult females, 2 (3.4%) were adult males, and 16 (27.1%) were fawns.

Based on general movement patterns delineated by the WGFD, mule deer generally migrate onto crucial ranges within the KPPA from the south (i.e., across I-80) (Map 3.11). Crucial winter/yearlong range within the KPPA is associated with the riparian habitat along the Medicine Bow River. Although specific mule deer movement patterns within the KPPA are unknown, it is likely, especially during severe winters, that mule deer move out of the Simpson Ridge and Foote Creek Rim areas and into this range.

As with pronghorn, existing roads within the KPPA probably do not interfere with mule deer migration routes. Easterly et al. (n.d.) found that roads associated with oil and gas fields in mule deer crucial winter range (central Wyoming) did not interfere with mule deer use of the area. However, occasional heavy traffic (e.g., along State Highway 72) may preclude mule deer crossings for short periods of time. Although fences generally do not impede mule deer movement, deep snow and startling events (e.g., the rapid approach of a vehicle) can make fences a source of mortality. Fence kills accounted for 13% of 144 mule deer deaths caused by factors other than hunting and winterkill in the Ruby-Butte Deer Herd in Nevada (Papez 1976). It is likely that the only fences within or immediately adjacent to the KPPA that substantially impede mule deer movements are those south of the area along I-80.

<u>White-tailed Deer</u>. White-tailed deer within the KPPA belong to the Laramie River Herd Unit, which consists of Hunt Areas 70 through 81, 83, and 161 (WGFD 1994a). The WGFD population objective for this herd is 1,000 animals, and the 1993 end-of-year population estimate was 1,022 white-tailed deer, or 102.2% of objective (Table 3.10). The five-year population average (1989-1993) was 118.9% of objective, or 1,189 deer. The population of the Laramie River Herd peaked in 1992 at 1,284 deer; the dramatic decline in 1993 was largely due to high mortality during the winter of 1992-93 (WGFD 1994a). The WGFD anticipates that the 1994 population for the herd will be slightly less than objective, or 983 animals.

Dense deciduous riparian communities are the favored habitat of white-tailed deer (Clark and Stromberg 1987). In the areas within and adjacent to the KPPA, white-tailed deer habitat is restricted to the Medicine Bow River and Rock Creek drainages and adjacent floodplains (Map 3.12). The southernmost portion of the Foote Creek Rim area (149 ac) is considered winter/yearlong range; the remainder is not considered white-tailed deer habitat (Table 3.11). According to WGFD range maps, no white-tailed deer habitat occurs within



Map 3.12 White-tailed Deer Herd Units and Range Types.

the Simpson Ridge area. All three transmission line routes cross white-tailed deer yearlong range associated with the Medicine Bow River; acreage traversed ranges from 23 ac (Alternate 1) to 30 ac (Alternate 3).

The 149 ac of white-tailed deer winter/yearlong range within the KPPA represents approximately 0.1% of this range type for the Laramie River Herd. Yearlong range traversed within the KPPA (81 ac) represents less than 0.1% of this habitat within the herd unit.

Twelve observations of white-tailed deer occurred within 0.5 mi (0.8 km) of the Foote Creek Rim area between April 20 and November 30, 1994 (Mariah 1994a). All twelve observations were below the eastern slope of Foote Creek Rim in areas of aspen and other dense vegetation.

White-tailed deer have not been observed within the Simpson Ridge area (Mariah 1994a).

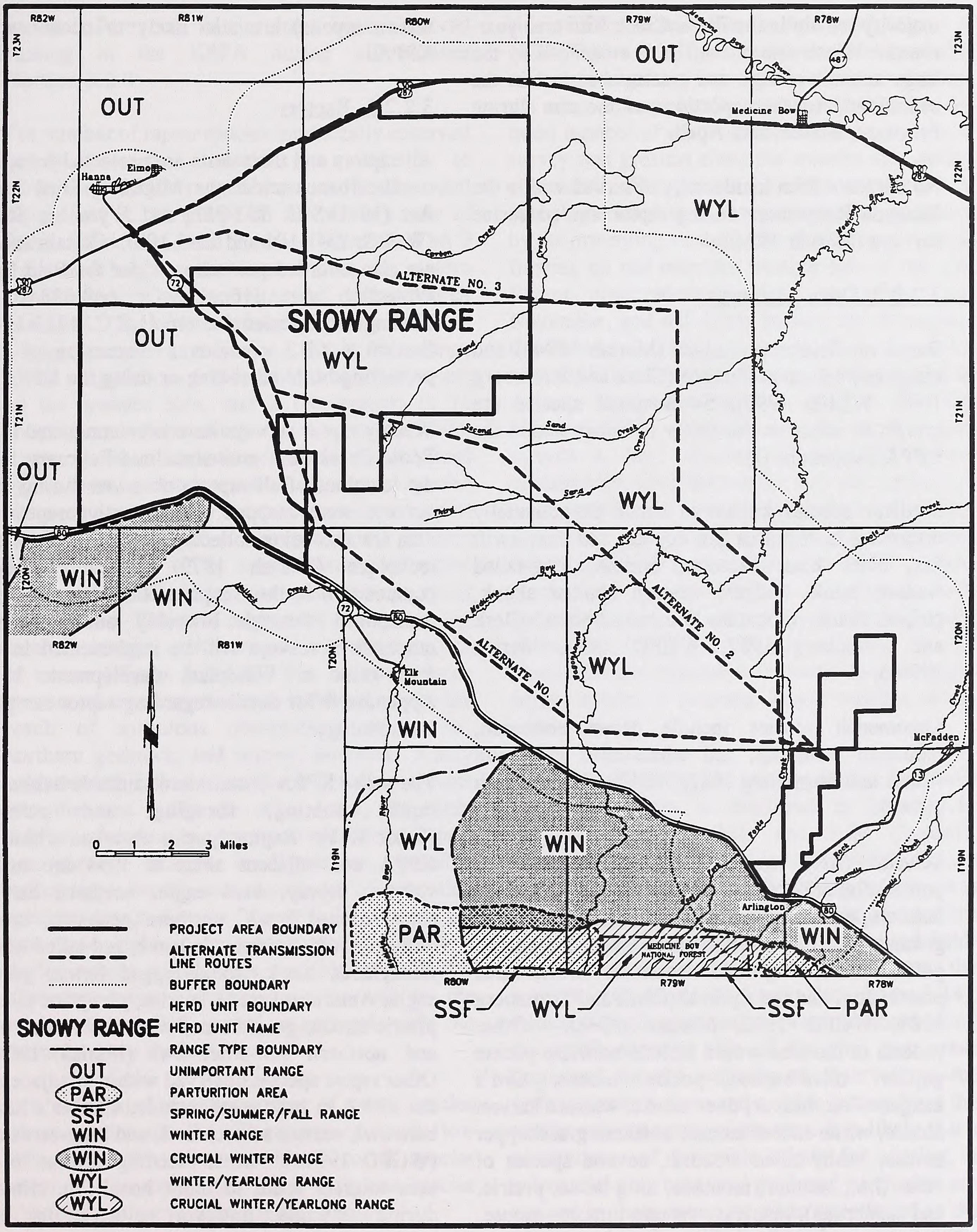
White-tailed deer movement within and adjacent to the KPPA occurs along the Medicine Bow and Rock Creek drainages and adjacent floodplains and wet meadows. Seasonal movement would be limited in extent and would likely consist of localized shifts [i.e., 10 to 20 mi (16-32 km)] within the riparian corridors (Halls 1978).

<u>Elk</u>. Elk in the KPPA are part of the Snowy Range Herd, which includes Hunt Areas 8 through 12, 110, and 114 (WGFD 1994a) (Map 3.13). The WGFD population objective for the Snowy Range Herd is 4,900 animals, and the estimated end-of-year population in 1993 was 6,888 elk, or 140.6% of objective (Table 3.10). The five-year population average (1989-1993) was 6,188 animals, or 126.3% of objective. The population of the Snowy Range Herd increased from 1991 to 1993, at which point it was at its highest level since 1986 (WGFD 1994a). A liberal hunting season in 1994 is expected to reduce the population slightly, to approximately 6,515 elk.

Elk winter range is generally associated with foothills, rugged terrain, and washes located within sagebrush-grassland habitats (Lyon and Ward 1982). Winter range is that range used by a population or portion of a population annually in substantial numbers only during winter, and crucial winter range is defined as winter range which determines whether a population maintains and reproduces itself at or above the WGFD population objective over the long-term (WGFD n.d.).

All of the Foote Creek Rim area is considered winter/yearlong habitat for the Snowy Range Herd, as are 36,147 ac (65.8%) in the Simpson Ridge area (Table 3.11). The remainder of the Simpson Ridge area is outside of any elk herd unit and is considered unimportant to elk. The central area between Foote Creek Rim and Simpson Ridge contains elk winter/yearlong range. Between 207 ac (Alternate 2) and 269 ac (Alternate 3) of elk winter/yearlong range would be crossed by the proposed transmission line. Elk crucial winter and winter/yearlong range exists across I-80 immediately south of Foote Creek Rim; parturition, or birthing, areas are also located south of I-80 and Foote Creek Rim. The 41,858 ac of elk winter/yearlong range within the KPPA represents approximately 19% of this range type within the Snowy Range Elk Herd.

Between February 23 and November 30, 1994, 215 observations of elk were recorded in the Foote Creek Rim area (Mariah 1994a). The majority of these observations (89.8%) occurred during March, although elk have been observed in the Foote Creek Rim area every month of the observation period except September and October. A herd of 40 to 50 bull elk was observed on several occasions during March on both the top of Foote Creek Rim and the flats below the western slope of the rim. Also, approximately 25 cow elk and young were observed using the eastern slope of the rim in March. Although some of these elk may move south across I-80 to access higher elevation summer range, it is likely that the



Map 3.13 Elk Herd Units and Range Types.

majority remain in the Foote Creek Rim area year-round. Winter use of the rim is evidenced by the large amount of sign and tracks observed in the central and southern portions of the rim during February, March, and April.

No elk have been incidentally observed within the Simpson Ridge area during raptor and passerine surveys (Mariah 1994a).

3.2.2.2 Other Mammals

Based on field observations (Mariah 1994a) and range and habitat preference (Clark and Stromberg 1987, WGFD 1992), 54 mammal species are known to occur or are likely to occur within the KPPA (Appendix D).

Predator species known to occur or potentially occurring in the area are coyote, red fox, swift fox, black bear, raccoon, ermine, long-tailed weasel, mink, badger, western spotted skunk, striped skunk, mountain lion, and bobcat (Clark and Stromberg 1987, WGFD 1992, Mariah 1994a).

Lagomorph species include desert cottontail, mountain cottontail, and white-tailed jackrabbit (Clark and Stromberg 1987, WGFD 1992, Mariah 1994a).

Sciurids (i.e., squirrels) known to occur or potentially occurring within the KPPA include least chipmunk, yellow-bellied marmot, Wyoming ground squirrel, thirteen-lined ground squirrel, golden-mantled ground squirrel, white-tailed prairie dog, and red squirrel (Clark and Stromberg 1987, WGFD 1992, Mariah 1994a). Other rodents in the area would include northern pocket gopher, olive-backed pocket mouse, Ord's kangaroo rat, beaver, deer mouse, western harvest mouse, white-footed mouse, northern grasshopper mouse, bushy-tailed woodrat, several species of voles (i.e., heather, montane, long-tailed, prairie, and sagebrush), muskrat, western jumping mouse, and porcupine. Several species of shrews (i.e., masked, dusky, water, and Merriam's) and bats (i.e., silver-haired, big brown, hoary, and little brown myotis) are also likely to occur on the KPPA.

3.2.2.3 Raptors

All raptors and their nests are protected from take or disturbance under the Migratory Bird Treaty Act (16 U.S.C. 703-711) and Wyoming Statute (W.R.S. 23-1-101 and 23-3-108). Certain species are also afforded protection under the Bald Eagle Protection Act (16 U.S.C. 668-688d) and Endangered Species Act (16 U.S.C. 1513-1543). Section 4.2.3.3 contains a discussion of laws protecting birds inhabiting or using the KPPA.

Weekly raptor surveys have been conducted in the Foote Creek Rim area since mid-February 1994; the locations of all raptors observed during these surveys were mapped. Quantitative raptor use data are also being collected using a skyline watch technique (Mariah 1979). Raptor species composition in the Simpson Ridge area is being determined through biweekly surveys; more quantitative surveys will be implemented in this area prior to Windplant development. See Appendix A for details regarding raptor sampling methodology.

The entire KPPA is considered suitable habitat for raptor hunting, foraging, and perching (Table 3.11). Raptor species observed within the KPPA and adjacent areas in 1994 are turkey vulture, osprey, bald eagle, northern harrier, sharp-shinned hawk, northern goshawk, broad-winged hawk, Swainson's hawk, red-tailed hawk, ferruginous hawk, rough-legged hawk, golden eagle, American kestrel, merlin, peregrine falcon, prairie falcon, great horned owl, short-eared owl, and northern saw-whet owl (Mariah 1994a). Other raptor species observed within or adjacent to the KPPA in past years include, Cooper's hawk, barn owl, eastern screech owl, and long-eared owl (WGFD 1994b). Most breeding species in the area migrate south to more hospitable climates during the winter; however, golden eagles, bald eagles, and great horned owls remain year-round. Rough-legged hawks move into the KPPA during the winter and move north during the breeding

season. Peregrine falcons have been observed hunting in the KPPA during all seasons (Section 3.2.3).

The number of raptor species incidentally observed during passerine surveys (i.e., March to November, 1994) ranged from 4 (October and November) to 13 (May) on the western side of Foote Creek Rim, and from 3 (November) to 9 (June and July) on the eastern side; the eastern side of the rim was not surveyed during March and April. The number of raptor species observed during raptor use surveys (i.e., July to November, 1994) ranged from 6 (November) to 10 (August) on the western side, and 2 (November) to 11 (August and September) on the eastern side. Raptor species observation data were standardized by converting total number of raptor species observed per month to the mean number of raptor species observed per survey per month [Figure 3.2(A), 3.2(B)]. The mean number of raptor species observed during passerine surveys along Foote Creek Rim was highest in the spring and summer months, and decreased with the approach of winter [Figure 3.2(A)]. The relatively large number of raptor species seen in May could be the result of fortuitous observations of merlin, northern goshawk, and osprey; however, it may represent an influx of summer breeding species into the area. On the other hand, the mean number of raptor species observed during raptor use surveys peaked in September, possibly indicating a southbound movement of migrating species through the area [Figure 3.2(B)]. Overall, the mean number of raptor species observed during raptor use surveys was higher than that observed during passerine surveys due to the longer observation period associated with the former survey method.

It is anticipated that the number of raptor species observed per month will remain relatively low throughout the winter, with 3 to 5 species observed per month (i.e., less than one species observed per survey) during the winter.

The highest mean number of raptor observations per passerine survey occurred along the western side of Foote Creek Rim in April and August of 1994 [Figure 3.2(C)]; these peaks were probably related to migratory movements of raptors through the area. Except for September and October, the mean number of raptor observations per passerine survey was greatest along the western side during any month. This greater use of the western side is probably related to the soaring currents generated by the prevailing westerly and southwesterly winds flowing up and over the western side of the rim. Raptor observations declined in October and November, and will likely remain low throughout the winter. The mean number of raptor observations per raptor use survey was highest in August along the eastern side of the rim [Figure 3.2(D)]. Possible reasons for this peak include a large number of American kestrel observations along the eastern side and a period of southeasterly and east-southeasterly winds during the month. In general, golden eagles comprised the majority of raptors observed in all months during both survey methods; American kestrels and red-tailed hawks were also frequently observed during the spring and summer months. Raptor observations in November included several rough-legged hawks, a common winter resident of the area.

The intensity of raptor activity within the Foote Creek Rim area is displayed in Maps 3.14 (eagles), 3.15 (hawks), and 3.16 (falcons). Contours are based on the locations where raptors were first observed. Sampling effort was approximately equal for the western and eastern sides of the rim. Eagles (i.e., golden and bald) were observed almost exclusively along the western side of Foote Creek Rim (Map 3.14). Although eagle observations were scattered along the entire western side of the rim, two areas accounted for the majority of observations--the central western slope and a ridge jutting from the northwestern portion of the rim. It is likely that a combination of favorable winds for soaring, a substantial prey base, and preferred perch sites are present in these areas; no nests were found in the areas, and it is unlikely that these areas offer substantial nesting habitat. Although somewhat more common on the western side, hawks (i.e.,

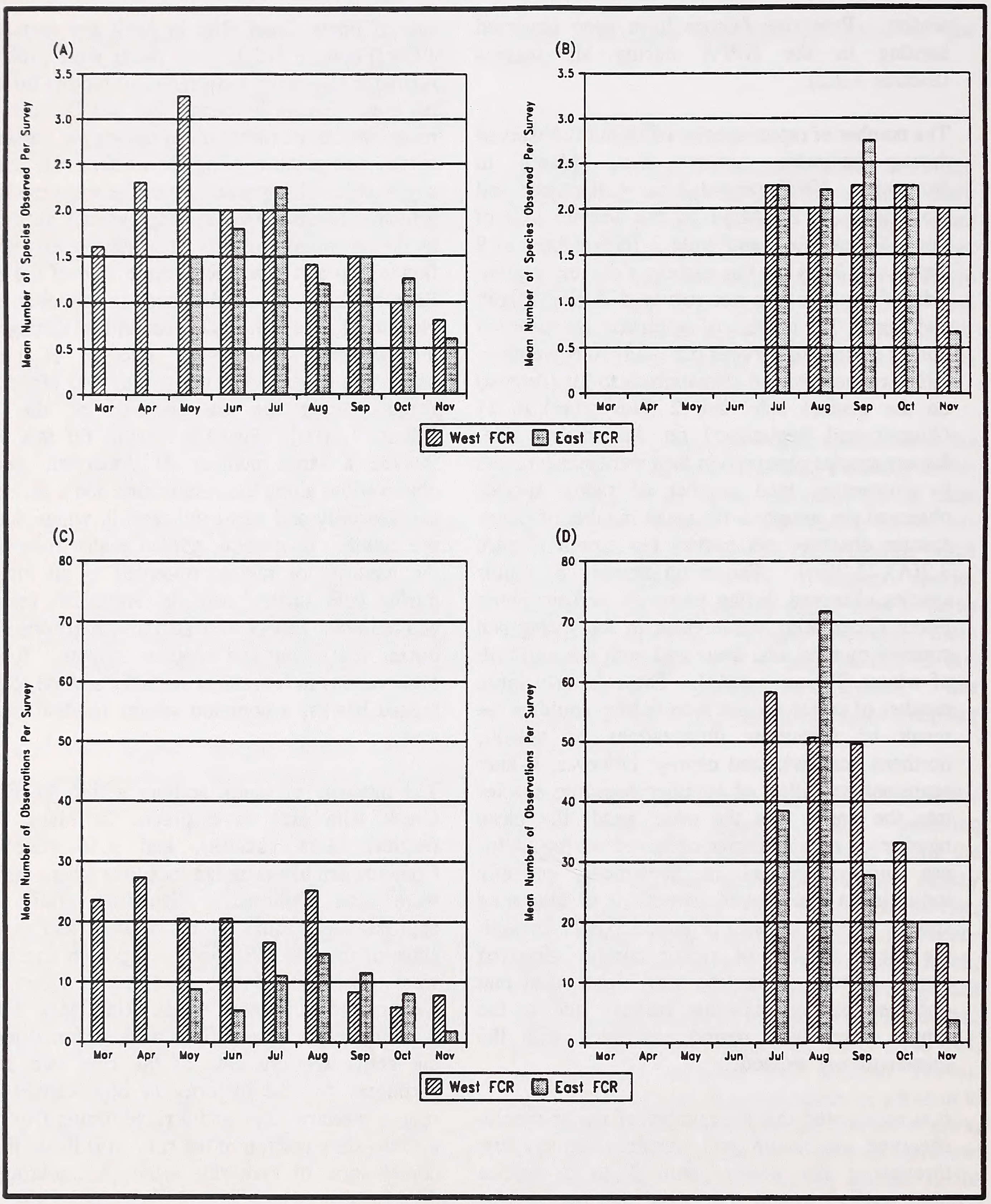
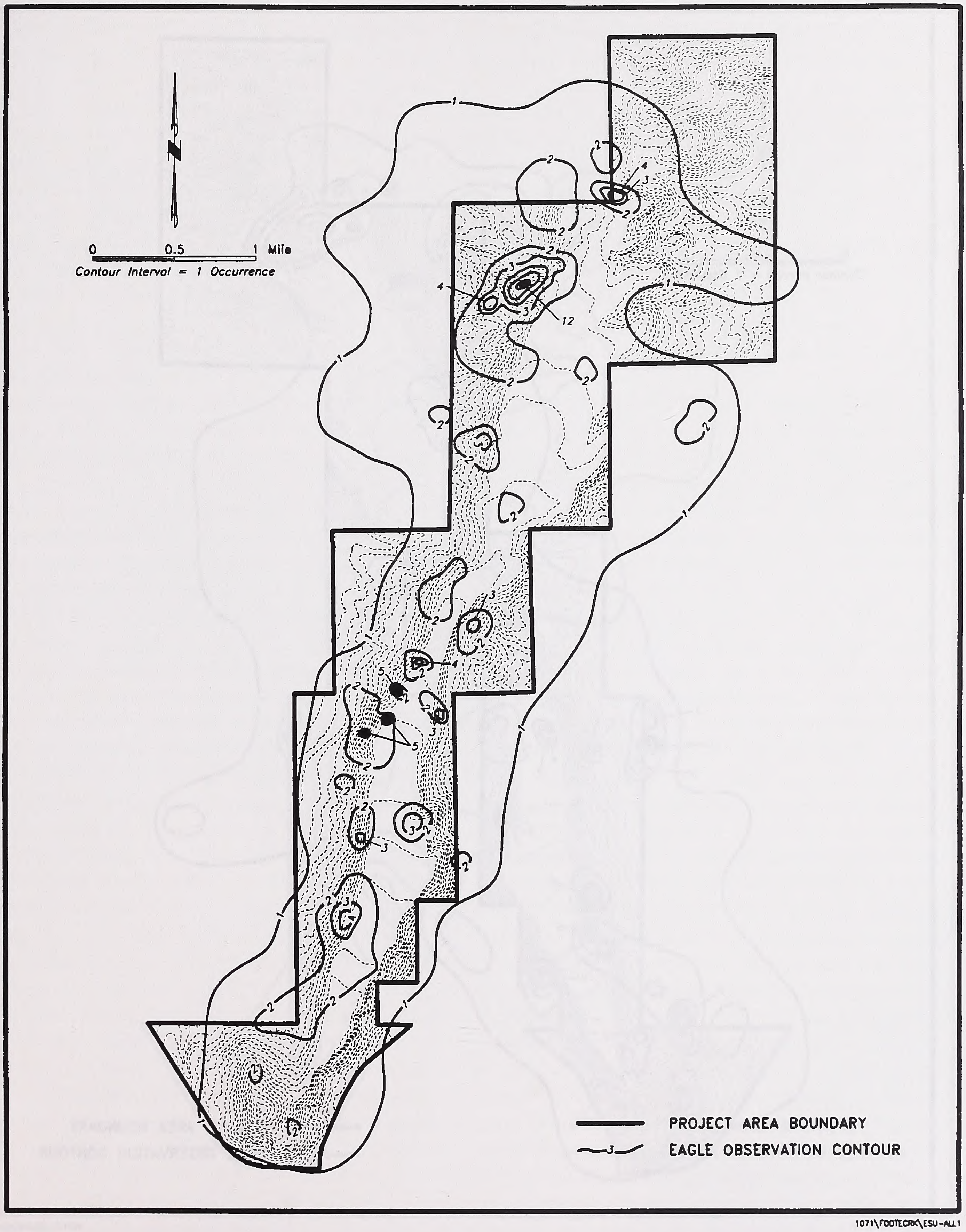
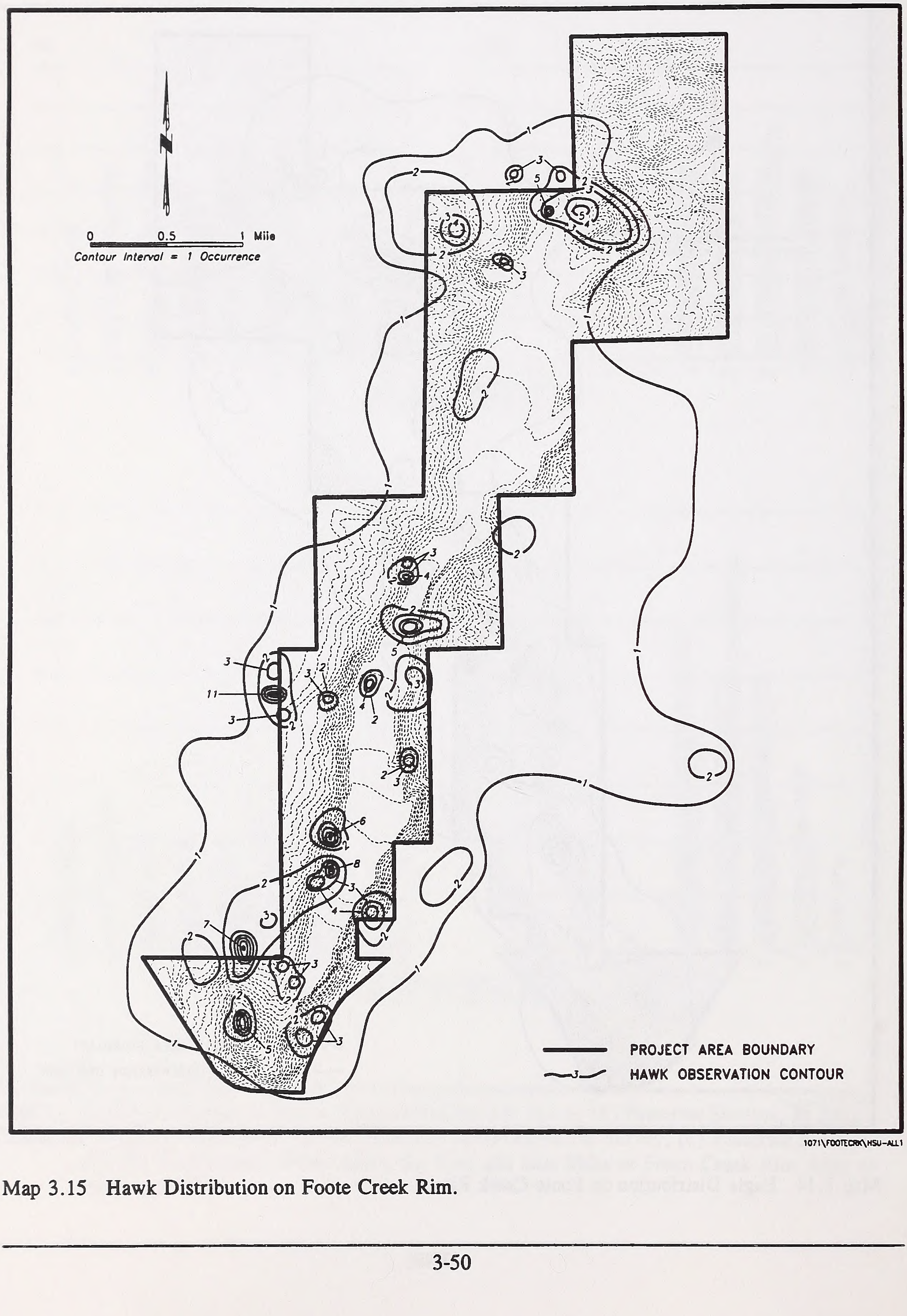


Figure 3.2 The Mean Number of Raptor Species Observed Per Survey (A) Passerine Surveys; B) Raptor Use Surveys and Mean Number of Raptor Observations Per Survey; (C) Passerine Surveys; and (D) Raptor Use Surveys Along the West and East Sides of Foote Creek Rim, May to November 1994.



Map 3.14 Eagle Distribution on Foote Creek Rim.



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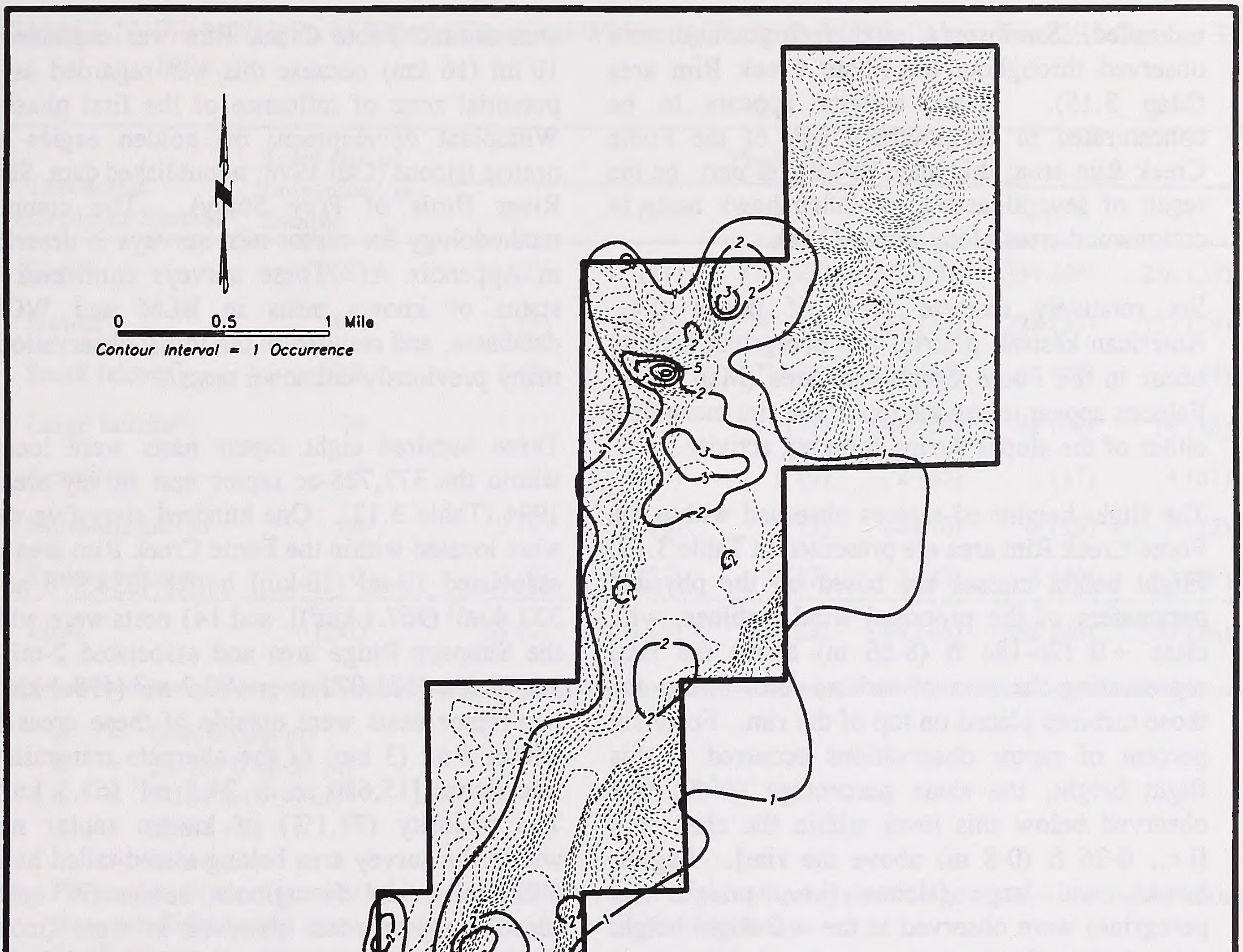
Map 3.15 Hawk Distribution on Foote Creek Rim.



Map 3.16 Falcon Distribution on Foote Creek Rim.

red-tailed, Swainson's, and ferruginous) were observed throughout the Foote Creek Rim area (Map 3.15). Hawk activity appears to be concentrated in the southern half of the Foote Creek Rim area; this may, at least in part, be the result of several active red-tailed hawk nests in cottonwood trees along Foote Creek.

Six relatively discrete areas of falcon (i.e., American kestrel, prairie, and peregrine) activity occur in the Foote Creek Rim area (Map 3.16). Falcons appear to use the top of the rim more than either of the slopes during foraging activity.

The flight heights of raptors observed within the Foote Creek Rim area are presented in Table 3.12. Flight height classes are based on the physical parameters of the proposed wind turbines, with class +B [26-184 ft (8-56 m) above the rim] representing the area of turbine rotor sweep for those turbines placed on top of the rim. Forty-six percent of raptor observations occurred at this flight height; the same percentage (46%) was observed below this level within the class +A [i.e., 0-26 ft (0-8 m) above the rim]. Eagles, hawks, and large falcons (i.e., prairie and peregrine) were observed at the +B flight height more frequently than at any other height; these birds often soar and hunt at this height level. Small falcons (i.e., American kestrel and merlin) were observed most frequently at flight height class +A. Small falcons, as well as the northern harrier (70% of observations within class +A), hunt by soaring and hovering low over the ground and pouncing on prey (Scott 1987).

Most raptor nests are located in topographically diverse areas, and the numerous rock outcrops, riparian drainages, and cliffs within and adjacent to the KPPA provide suitable substrates for raptor nesting. Aerial and ground surveys for raptor nests within and adjacent to the KPPA were conducted during the spring and summer of 1994. The surveys encompassed the Foote Creek Rim area plus a 10-mi (16-km) buffer (excluding forested land south of I-80), and the Simpson Ridge area and proposed alternate transmission line routes plus a 2-mi (3-km) buffer. The survey area around Foote Creek Rim was expanded to 10 mi (16 km) because this was regarded as the potential zone of influence of the first phase of Windplant development on golden eagles and prairie falcons (Call 1978; unpublished data, Snake River Birds of Prey Study). The complete methodology for raptor nest surveys is described in Appendix A. These surveys confirmed the status of known nests in BLM and WGFD databases, and resulted in the initial observation of many previously unknown nests.

Three hundred eight raptor nests were located within the 377,728-ac raptor nest survey area in 1994 (Table 3.13). One hundred sixty-five nests were located within the Foote Creek Rim area and associated 10-mi (16-km) buffer [238,976 ac or 373.4 mi^2 (967.1 km^2)], and 141 nests were within the Simpson Ridge area and associated 2-mi (3-km) buffer [123,072 ac or 192.3 mi^2 (498.1 km^2)]; two raptor nests were outside of these areas but within 2 mi (3 km) of the alternate transmission line routes [15,680 ac or 24.5 mi^2 (63.5 km^2)]. The majority (73.1%) of known raptor nests within the survey area belong to red-tailed hawks (128 nests) and ferruginous hawks (97 nests). Inactive raptor nests observed in trees (mostly limber pines) were assigned to either red-tailed hawks or ferruginous hawks. Other raptor nests observed during the survey belong to golden eagle (43 nests), bald eagle (1 nest), Swainson's hawk (30 nests), American kestrel (2 nests), and prairie falcon (7 nests). Of the 65 known active raptor nests observed during the survey, the majority (76.9%) belonged to red-tailed hawk (20 nests), ferruginous hawk (17 nests), or Swainson's hawk (13 nests) (Table 3.13). The remaining active nests include golden eagle (5 nests), bald eagle (1 nest), American kestrel (2 nests), and prairie falcon (7 nests). Other raptor species reported to have nested within the survey area include great horned owl and eastern screech owl (WGFD 1994b).

A total of 121 raptor nests was located within 2 mi (3 km) of the three alternate transmission line routes (Table 3.14). Approximately 23% of these nests were active, with the majority (89%) of these

Table 3.12 Flight Heights of Raptors Observed Within the Foote Creek Rim Area, June 29 - October 31, 1994.

Taxonomic Group or Species	Total No. of Individuals in Sample	Flight Height Class[1]					
		-C	-B	-A	+A	+B	+C
Eagles	683	16 (2)[2]	77 (11)	170 (25)	273 (40)	334 (49)	226 (33)
Hawks	434	11 (3)	25 (6)	80 (18)	165 (38)	228 (53)	127 (29)
Small falcons[3]	238	5 (2)	19 (8)	72 (30)	164 (69)	65 (27)	9 (4)
Large falcons[4]	78	1 (1)	4 (5)	21 (27)	46 (59)	48 (62)	14 (18)
Accipiters	6	0 (0)	0 (0)	0 (0)	2 (33)	1 (17)	4 (67)
Northern harrier	60	0 (0)	5 (8)	8 (13)	42 (70)	9 (15)	7 (12)
Turkey vulture	6	0 (0)	1 (17)	1 (17)	2 (33)	3 (50)	3 (50)
Total	1,505	33 (2)	131 (9)	352 (23)	694 (46)	688 (46)	390 (26)

[1] A = 0-26 ft (0-8 m)
B = 26-184 ft (8-56 m)
C = >184 ft (>56 m)
+ = above rim
- = below rim

[2] Percentage of total number of individual observations in parentheses; percentages do not total since more than one flight height class may be assigned to a single observation.

[3] Small falcons are American kestrel and merlin.

[4] Large falcons are prairie falcons and peregrine falcons.

active nests used by ferruginous hawk (8 nests), prairie falcon (8 nests), red-tailed hawk (5 nests), and Swainson's hawk (4 nests). Fifty-two raptor nests occur within 2 mi (3 km) of Alternate 3, 28 nests within 2 mi (3 km) of Alternate 2, and 19 nests within 2 mi (3 km) of Alternate 1. The remaining 22 raptor nests are within 2 mi (3 km) of joint routes.

Density of raptor nests is greatest in the Simpson Ridge area and associated 2-mi (3-km) buffer, with approximately 0.75 nest/mi^2 (0.3 nest/km^2). Within the potential zone of influence for the Foote Creek Rim area [i.e., Foote Creek Rim area and associated 10-mi (16-km) buffer], raptor nest density is 0.44 nest/mi^2 (0.2 nest/km^2). Overall, there is approximately 0.53 nest/mi^2 (0.2 nest/km^2) within the 1994 raptor nest survey area. The raptor nest densities found within the survey area [i.e., 0.44-0.75 nest/mi^2 (0.2-0.3 nest/km^2)] are similar to those reported for areas immediately north of the survey area. Raptor nest data from a coalbed methane project north of Hanna, Wyoming (Mariah 1992) indicate a raptor nest density of 0.78 nest/mi^2 (0.2 nest/km^2), which is similar to nest density within the Simpson Ridge area. The overall raptor nest density within the 1994 survey area [0.53 nest/mi^2 (0.2 nest/km^2)] is similar to the density of 0.48 nest/mi^2 (0.2 nest/km^2) extrapolated from raptor surveys at coal mines adjacent to Hanna, Wyoming (Mariah 1989). A relatively high raptor nest density of 2.0 nests/mi^2 (0.7 nest/km^2) has been noted within the permit area of a surface coal mine located

Table 3.13 Number of Active and Inactive Nests of Raptor Species Within the 1994 Raptor Nest Survey Area.

Raptor Species	1994 Nest Status[1]	Foote Creek Rim Area[2]	Simpson Ridge Area[3]	Other Areas Within the KPPA[4]	Total Raptor Nest Survey Area
Golden eagle	Active	4	1	0	5
	Inactive	29	9	0	38
Bald eagle	Active	0	1	0	1
	Inactive	0	0	0	0
Red-tailed hawk	Active	13	7	0	20
	Inactive	75	31	2	108
Swainson's hawk	Active	3	10	0	13
	Inactive	7	10	0	17
Ferruginous hawk	Active	8	9	0	17
	Inactive	24	56	0	80
American kestrel[5]	Active	0	2	0	2
	Inactive	0	0	0	0
Prairie falcon	Active	2	5	0	7
	Inactive	0	0	0	0
Subtotal	Active	30	35	0	65
	Inactive	135	106	2	243
Total		165	141	2	308

[1] A nest was considered active if one of the following was observed:
a) eggs were laid,
b) young were present, or
c) an adult was observed in incubating posture on the nest (Postupalsky 1974).

[2] Includes associated 10-mi (16-km) buffer (excluding forested land south of I-80).

[3] Includes associated 2-mi (3-km) buffer.

[4] Areas within 2 mi (3 km) of alternate transmission line routes but outside of the Foote Creek Rim and Simpson Ridge areas.

[5] Due to the difficulty of locating American kestrel nests, nests of this species were not a focus of the 1994 nest survey; however, two nests were incidentally located during the survey.

Table 3.14 Number of Active and Inactive Nests of Raptor Species Within 2 Mi (3 Km) of Alternate Transmission Line Routes, 1994.

Raptor Species	1994 Nest Status[1]	Alternate 1	Alternate 2	Alternate 3	Alternates 1 and 2[2]	Alternates 1, 2, and 3[2]	Total All Alternate Routes
Golden eagle	Active	1	0	1	0	0	2
	Inactive	0	10	4	2	0	16
Red-tailed hawk	Active	1	1	2	1	0	5
	Inactive	7	12	24	6	0	49
Swainson's hawk	Active	0	0	3	0	1	4
	Inactive	3	0	1	0	1	5
Ferruginous hawk	Active	5	1	1	1	0	8
	Inactive	2	2	12	2	5	23
American kestrel	Active	0	0	1	0	0	1
	Inactive	0	0	0	0	0	0
Prairie falcon	Active	0	2	3	3	0	8
	Inactive	0	0	0	0	0	0
Subtotal	Active	7	4	11	5	1	28
	Inactive	12	24	41	10	6	93
Total		19	28	52	15	7	121

[1] A nest was considered active if one of the following was observed:
a) eggs were laid,
b) young were present, or
c) an adult was observed in incubating posture on the nest (Postupalsky 1974).

[2] Refers to segments where the alternate routes merge near Hanna.

about 115 mi (185 km) west of the KPPA (Mariah 1994b).

In 1994, approximately 36.7% of the KPPA (22,248 ac) was included within raptor nest buffers [i.e., areas within 0.75 mi (1.21 km) of a known active raptor nest]; these buffers covered 36.8% of the Simpson Ridge area (20,218 ac) and 38.4% of the Foote Creek Rim area (1,920 ac). However, activity status of raptor nests varies from year to year (Mariah 1988a, 1988b; Bent 1937). In a scenario in which all raptor nests were active in the same season (an unlikely event), approximately 64.9% of the KPPA (39,369 ac) would be included within raptor nest buffers; these buffers would cover 65.9% of the Simpson Ridge area (36,170 ac) and 55.4% of the Foote Creek Rim area (2,771 ac) (Table 3.11). The purpose of these raptor nest buffers is to protect active nests and immediately surrounding habitat from surface-disturbing activities (and associated noise, dust, etc.) during the breeding season (i.e., February 1 to July 31) (BLM 1987:471-472).

Forty raptor nests within the 1994 raptor nest survey area produced 80 nestlings (i.e., an average of 2 nestlings per nest); eight additional nests failed, and the status of 15 nests could not be determined with certainty (Table 3.15). The highest nestling productivity was among ferruginous hawks (11 nests produced 26 nestlings) and Swainson's hawks (8 nests produced 18

Table 3.15 Nestling Productivity for Active Nests of Raptor Species Within the 1994 Raptor Nest Survey Area.[1]

Raptor Species	Number of Nests Producing Nestlings	Total Number of Nestlings	Number of Nests that Failed[2]	Number of Nests with Unknown Status[3]
Golden eagle	3	4	0	2
Bald eagle	1	1	0	0
Red-tailed hawk	14	26	3	3
Swainson's hawk	8	18	3	2
Ferruginous hawk	11	26	1	5
Prairie falcon	3	5	1	3
Total	40	80	8	15

[1] The 1994 raptor nest survey area includes the Foote Creek Rim area and associated 10-mi (16-km) buffer, Simpson Ridge area and associated 2-mi (3-km) buffer, and the three alternate transmission routes with associated 2-mi (3-km) buffers.

[2] A failed nesting attempt was considered either:

1) a nest that originally was active (see Table 3.14, Footnote 1 for definition), but that contained no eggs or young (or unhatched eggs but no adults) upon recheck prior to the fledging period; or
2) a nest with damaged eggs or dead nestlings (i.e., no viable young) resulting from predation.

[3] Nests that were checked late in the fledging period (i.e., nestling/fledgling status could not be determined with certainty).

nestlings). Red-tailed hawks also had relatively high nestling production, with 14 nests producing 26 nestlings. Prairie falcons (3 nests produced 5 nestlings), golden eagles (3 nests produced 4 nestlings), and bald eagles (1 nest produced 1 nestling) exhibited relatively low nestling productivity. It should be noted, however, that nestling productivity estimates reflect high variability due to the small number of nests.

Fledging success (i.e., the percentage of nestlings that fledged from the nest) was high among all nesting raptor species within the 1994 raptor nest survey area (Table 3.16). Fledging success ranged from 87% to 100%; very few birds that attained nestling status failed to fledge. As with nestling productivity, however, fledgling success data contain a high degree of uncertainty due to the small number of nests with fledglings in the survey area.

Raptor species that migrate through Wyoming (e.g., Swainson's hawk, ferruginous hawk) pass through the KPPA on their way north or south (depending on season); the extent of this movement through the area (e.g., along Foote Creek Rim) is currently under study, and the results of this study will be included in the FEIS.

Table 3.16 Fledging Success for Active Nests of Raptor Species Within the 1994 Raptor Nest Survey Area.[1]

Raptor Species	Number of Nests[2]	Number of Nestlings	Number of Fledglings[3]	% of Nestlings Fledged[4]
Golden eagle	2	4	4	100.0
Bald eagle	1	1	1	100.0
Red-tailed hawk	9	15	13	86.7
Swainson's hawk	8	17	17	100.0
Ferruginous hawk	6	14	13	92.9
Prairie falcon	3	5	5	100.0
Total	29	56	53	94.6

[1] A nest was considered active if one of the following was observed:
a) eggs were laid,
b) young were present, or
c) an adult was observed in incubating posture on the nest (Postupalsky 1974).

[2] Nests for which both nestling and fledgling data were available.

[3] A fledgling was any nestling with ≥90% of its body covered with feathers, whether or not it had attempted to leave the nest.

[4] Percent of nestlings fledged = number of fledglings/number of nestlings x 100.

The Hanna RCA covers approximately 17.4% (9,575 ac) of the Simpson Ridge area (Map 3.9), and likely contributes to the relatively high nest density observed within the Simpson Ridge area. RCAs are characterized by cliffs or other geologic formations and contain high concentrations of nesting ferruginous hawks and/or golden eagles and prairie falcons (BLM 1987:205-207). All three alternate transmission line routes traverse the Hanna RCA; Alternate 3 crosses the least amount of acreage (58 ac) and Alternate 2 crosses the greatest amount (92 ac).

3.2.2.4 Upland Game Birds

Three species of upland game birds--sage grouse, blue grouse, and mourning dove--occur on or adjacent to the KPPA.

Sage Grouse. Sage grouse habitat is characterized by an interspersed mixture of sagebrush and grassland. In winter, sage grouse use tall, dense stands of sagebrush that remain relatively exposed through deep snow (Greer n.d.); low sagebrush on windswept knolls are also used as feeding sites. During the spring, sage grouse gather on breeding grounds, or leks, characterized by open areas (e.g., meadows, low sagebrush zones) surrounded by denser sagebrush cover (Greer n.d.). Sage grouse return year after year to these leks, although their exact location may shift slightly between years. The area within 0.25 mi (0.40 km) of a lek center is considered potential breeding habitat, and is protected from surface disturbance through a BLM surface disturbance stipulation (BLM 1987:204). Sage grouse tend to nest within 2 mi (3 km) of the lek center (BLM 1987:202, Greer n.d.); this area is considered

probable nesting habitat, and is closed to surface-disturbing activity from February 1 to July 31 (BLM 1987:471). Wallestad and Pyrah (1974) determined that 68% of sage grouse nests were within 1.5 mi (2.4 km) of leks in central Montana. Braun et al. (1977) confirmed that the area within 2 mi (3 km) of a lek often includes 60 to 80% of the nesting sage grouse from the lek. A large proportion of sage grouse nests (92%) may be protected from disturbance through application of a 2-mi (3-km) buffer (Wakkinen et al. 1992). Sage grouse select sagebrush-grassland habitats with relatively tall sagebrush and canopy coverage ranging from approximately 10 to 40% in which to build nests (Wallestad and Pyrah 1974, Rothenmaier 1979).

Forty-four sage grouse leks occur within the KPPA and its adjacent 2-mi (3-km) buffer; 36 of these leks are historic sites (i.e., inactive in 1994) noted in BLM (1994a) and WGFD (1994b) records. Since all 44 leks represent sites chosen by sage grouse for reproductive activity, then approximately 3,110 ac within the Simpson Ridge area (5.7%) is potential sage grouse breeding habitat; no breeding habitat occurs within the Foote Creek Rim area (Table 3.11). All three proposed transmission line alternate routes pass through potential breeding habitat, with the acreage traversed ranging from 4.8 ac (Alternate 2) to 9.7 ac (Alternate 1). A majority of the Simpson Ridge area (86.6% or 47,549 ac) is probable sage grouse nesting habitat, while only 98 ac within the Foote Creek Rim area (2.0%) would be suitable nesting habitat. All three alternate transmission line routes cross probable nesting habitat [182 ac (Alternate 1) to 212 ac (Alternate 3)].

Aerial and ground surveys in 1994 revealed that eight of the 44 leks within and adjacent to the KPPA were active. Seven were located within the Simpson Ridge area, and one was located approximately 1.0 mi (1.6 km) southeast of the Simpson Ridge area. Based on only these eight active leks, approximately 848 ac within the Simpson Ridge area (1.5%) is potential sage grouse breeding habitat and 34,930 ac (63.6%) is probable nesting habitat. All three proposed transmission line alternates traverse probable active nesting habitat--Alternate 1 crosses 47 ac, Alternate 2 crosses 90 ac, and Alternate 3 crosses 141 ac. None of the routes traverse potential active sage grouse breeding habitat.

Ten sage grouse observations were recorded between April 20 and August 29, 1994, for the Foote Creek Rim area (Mariah 1994a). Only one of the observations occurred near the rim itself; all the rest occurred near bodies of water immediately east of the Foote Creek Rim area.

Forty-eight observations of sage grouse were made incidental to raptor and passerine surveys in the Simpson Ridge area between April 11 and August 16, 1994 (Mariah 1994a). Thirty-nine of these observations occurred on an active lek; the other nine occurred in sagebrush habitat along the eastern portion of Simpson Ridge.

Blue Grouse. Blue grouse prefer mountain shrubland, aspen-conifer woodland, and various forest types which are common throughout Wyoming (BLM 1987:204). Edges between these habitat types and riparian areas within and adjacent to these types are frequented.

Within the KPPA, blue grouse have only been observed on the eastern slope of Foote Creek Rim in a grassland-shrubland transitional zone (Mariah 1994a). It is likely that blue grouse occur in other areas within the KPPA, but they are probably restricted to limited areas of suitable habitat (e.g., wooded riparian zones, pine-grassland ecotones).

Mourning Dove. This species is a common breeding bird in habitats that occur in the KPPA. The birds migrate from the area in the fall and winter. Mourning dove concentrations are usually highest around power lines, buildings, and other areas of human disturbance, which occur on only a small portion of the KPPA. Doves prefer the shrub-covered areas along perennial water sources and washes that provide nesting and roosting cover.

Thirty-two observations of mourning doves were incidentally recorded during passerine and raptor surveys within the Foote Creek Rim area between May 4 and September 27, 1994 (Mariah 1994a). The majority of these observations were along the eastern slope of the rim in areas of sagebrush-grassland interspersed with trees and large shrubs; mourning doves likely bred in this area. Only one mourning dove was actually observed on top of Foote Creek Rim.

Only six observations of mourning doves were incidentally recorded for the Simpson Ridge area between April 25 and September 12, 1994 (Mariah 1994a). As with Foote Creek Rim, all of these observations were in areas of sagebrush-grassland intermixed with trees and shrubs; one observation was in the vicinity of an abandoned homestead.

3.2.2.5 Waterfowl, Shorebirds, and Waders

Several species of waterfowl have been observed on the various impoundments, reservoirs, and perennial creeks and rivers within and immediately adjacent to the KPPA. The most common waterfowl species observed in the KPPA are Canada goose, northern pintail, American wigeon, mallard, lesser scaup, and redhead (Mariah 1994a). Other species observed were snow goose, canvasback, ring-necked duck, bufflehead, common merganser, gadwall, green-winged teal, blue-winged teal, cinnamon teal, northern shoveler, and American coot. Waterfowl species not observed but potentially occurring on the KPPA based on range and habitat preference (Scott 1987, WGFD 1992) are ruddy duck, wood duck, common goldeneye, and red-breasted merganser. Waterfowl, as well as shorebirds and waders, use the KPPA during migration (spring and fall), and some species (e.g., Canada goose, mallard) probably breed in the area during spring and summer.

Shorebird and wading species observed on or adjacent to the KPPA are common loon, pied-billed grebe, American white pelican, double-crested cormorant, great blue heron, white-faced ibis, Virginia rail, sandhill crane, mountain plover, semipalmated plover, killdeer, American avocet, greater yellowlegs, spotted sandpiper, upland sandpiper, long-billed dowitcher, common snipe, Wilson's phalarope, Franklin's gull, California gull, and Caspian tern (Mariah 1994a). Many of these species are known to breed (e.g., mountain plover) or are likely to breed (e.g., American avocet) within the KPPA. Based upon range and habitat preference (Scott 1987, WGFD 1992), several other species of grebes, herons, egrets, plovers, sandpipers, gulls, and terns may occasionally move through the KPPA (Appendix D).

The majority of waterfowl and shorebird observations in the KPPA (74% or 2,989 observations) were located immediately east of the Foote Creek Rim area along a series of reservoirs and impoundments; these observations were noted during monthly reconnaissance surveys along the eastern slope of Foote Creek Rim and incidental to other surveys between March and November 1994 (Mariah 1994a). Common waterfowl species observed were redhead (982 observations), mallard (682 observations), Canada goose (375 observations), American wigeon (274 observations), gadwall (82 observations), common merganser (52 observations), cinnamon teal (50 observations), northern pintail (45 observations), and lesser scaup (44 observations). The majority of redheads were observed in large rafts on the reservoirs during March and April; they were likely migrating north. Shorebirds, waders, and other water birds observed immediately east of Foote Creek Rim include Franklin's gull (41 observations), pied-billed grebe (18 observations), double-crested cormorant (13 observations), great blue heron (12 observations), American avocet (10 observations), common loon (7 observations), killdeer (6 observations), and semipalmated plover (1 observation).

Two hundred ninety observations of waterfowl and shorebirds on top of Foote Creek Rim or flying along the top or upper slopes during passerine and raptor surveys were recorded between March and November 1994 (Mariah 1994a). Waterfowl species included Canada goose (62 observations),

mallard (7 observations), and ring-necked duck (1 observation). Shorebird, wader, and other water bird species observed on top of or flying above the rim were mountain plover (86 observations), gull species (38 observations), killdeer (13 observations), white-faced ibis (12 observations), California gull (12 observations), long-billed dowitcher (10 observations), great blue heron (8 observations), upland sandpiper (7 observations), American white pelican (4 observations), sandhill crane (2 observations), American avocet (1 observation), and common snipe (1 observation). Of those waterfowl/shorebirds/waders observed flying over or immediately adjacent to Foote Creek Rim, 45% of the observations were between 26 and 184 ft (8 and 56 m) above the rim (i.e., at proposed wind turbine rotor height).

One thousand sixty-one waterfowl and shorebird observations were noted during, and incidental to, surveys within the Simpson Ridge area between March and November 1994 (Mariah 1994a). Approximately 97% of these observations occurred on or immediately adjacent to seven bodies of water located within the Simpson Ridge area: Seven Mile Lake (northwest Sec. 32, T21N, R80W), Fiddler's Green Reservoir (Sec. 21, T21N, R80W), Sixmile Spring (Sec. 17 and 18, T21N, R80W), Jacks Spring (Sec. 5, T21N, R80W), Soda Lakes (Sec. 23, T21N, R81W), a tributary of Percy Creek (Sec. 11 to 14, T21N, R81W) and an unnamed pond (Sec. 13, T21N, R81W). Waterfowl species commonly observed within the Simpson Ridge area were mallard, Canada goose, northern pintail, American wigeon, and lesser scaup. Other waterfowl species occasionally seen were green-winged teal, redhead, canvasback, gadwall, common merganser, blue-winged teal, northern shoveler, and ring-necked duck. Shorebird, wader, and other water bird species observed within the Simpson Ridge area were American coot (150 observations), American avocet (73 observations), killdeer (54 observations), Wilson's phalarope (47 observations), great blue heron, American white pelican, and greater yellowlegs.

3.2.2.6 Passerines

Ninety-four species of passerine birds have been observed within the KPPA between February and November 1994 (Mariah 1994a). The horned lark, with 5,717 sightings, was the most commonly observed species within the KPPA. Other common species include mountain bluebird (622 sightings), cliff swallow (574 sightings), Brewer's blackbird (477 sightings), vesper sparrow (386 sightings), green-tailed towhee (351 sightings), sage thrasher (210 sightings), northern flicker, American goldfinch, Brewer's sparrow, western meadowlark, black-billed magpie, American robin, eastern bluebird, tree swallow, and yellow warbler. Additional passerine species known to occur or likely to occur (Scott 1987, WGFD 1992) within the KPPA are listed in Appendix D.

Weekly systematic surveys of passerines have been conducted within Foote Creek Rim and the Simpson Ridge areas since February 1994. The complete methodology for passerine surveys is described in Appendix A. Passerine sampling methodology and effort was equivalent between the western and eastern sides of Foote Creek Rim for May through November, 1994; therefore, data from these months are used for trend comparisons. The mean number of passerine species observed per survey along the western side of the rim peaked in June at 5.6 species/survey, and then gradually declined throughout the summer and into the fall; only 0.6 passerine species/survey was observed in November [Figure 3.3(A)]. This seasonal decline is a result of species that breed in the area moving south as the weather cools. The mean number of passerine species observed per survey along the eastern side of the rim peaked in July (10.5 passerine species/survey), and then, as with the western side, declined to a low of 0.8 species/survey in November [Figure 3.3(A)]. In every month, more passerine species were observed along the eastern side of the rim than along the western side. This higher passerine species diversity is likely a reflection of the greater vegetational structure and number of habitats along the eastern edge of Foote Creek Rim. Grassland

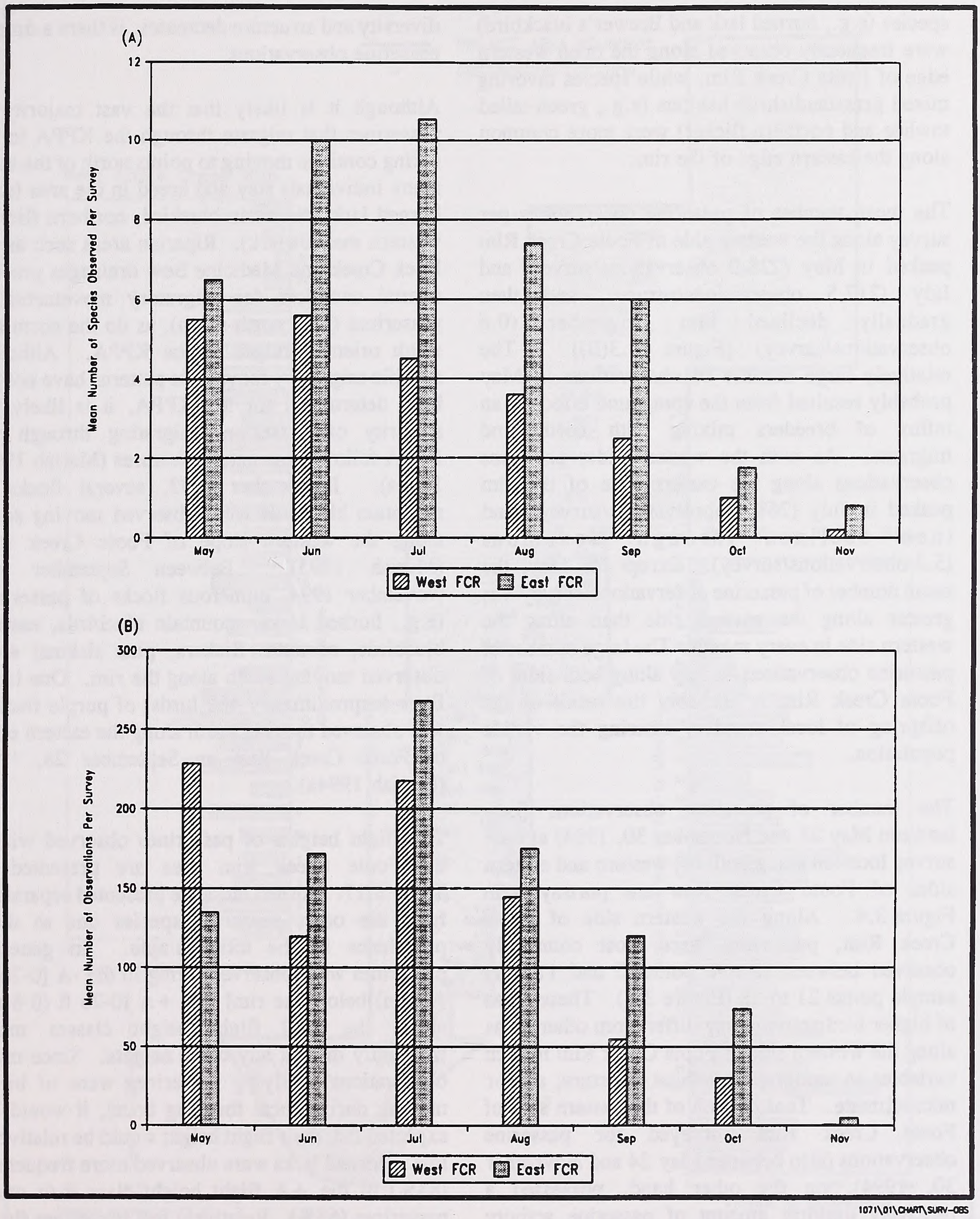


Figure 3.3 The (A) Mean Number of Passerine Species Observed Per Survey and (B) Mean Number of Passerine Observations Per Survey Along the West and East Sides of Foote Creek Rim (FCR), May to November 1994.

species (e.g., horned lark and Brewer's blackbird) were frequently observed along the open western edge of Foote Creek Rim, while species favoring mixed grassland/shrub habitats (e.g., green-tailed towhee and northern flicker) were more common along the eastern edge of the rim.

The mean number of passerine observations per survey along the western side of Foote Creek Rim peaked in May (228.0 observations/survey) and July (217.5 observations/survey), and then gradually declined into November (0.6 observations/survey) [Figure 3.3(B)]. The relatively large number of observations in May probably resulted from the compound effect of an influx of breeders mixing with northbound migrants. As with the western side, passerine observations along the eastern side of the rim peaked in July (268.0 observations/survey), and then declined through November (5.2 observations/survey). Except for May, the mean number of passerine observations/survey was greater along the eastern side than along the western side in every month. The large number of passerine observations in July along both sides of Foote Creek Rim is probably the result of the offspring of local breeders entering the visible population.

The number of passerine observations (i.e., between May 24 and November 30, 1994) at each survey location along both the western and eastern sides of Foote Creek Rim are portrayed in Figure 3.4. Along the western side of Foote Creek Rim, passerines were most commonly observed between sample points 2 and 11, and sample points 21 to 28 (Figure 3.4). These areas of higher bird activity may differ from other areas along the western side of Foote Creek Rim in such variables as topography, habitat structure, and/or microclimate. That portion of the eastern side of Foote Creek Rim surveyed for passerine observations (also between May 24 and November 30, 1994), on the other hand, possessed a relatively uniform amount of passerine activity along its length (Figure 3.4). Only along the northern end of the transect, where vegetation diversity and structure decreases, is there a drop in passerine observations.

Although it is likely that the vast majority of passerines that migrate through the KPPA in the spring continue moving to points north of the area, many individuals stay and breed in the area (e.g., horned lark, mountain bluebird, northern flicker, western meadowlark). Riparian areas such as the Rock Creek and Medicine Bow drainages provide natural corridors for migratory movements of passerines (i.e., north-south), as do the north and south oriented ridges in the KPPA. Although specific migratory movement patterns have not yet been determined for the KPPA, it is likely the majority of passerines migrating through the KPPA follow these natural features (Mariah 1993, 1994a). In October 1993, several flocks of mountain bluebirds were observed moving south along the western slope of Foote Creek Rim (Mariah 1993). Between September and November 1994, numerous flocks of passerines (e.g., horned larks, mountain bluebirds, eastern bluebirds, northern flickers, pine siskins) were observed moving south along the rim. One large flock (approximately 460 birds) of purple finches was observed moving south along the eastern edge of Foote Creek Rim on September 28, 1994 (Mariah 1994a).

The flight heights of passerines observed within the Foote Creek Rim area are presented in Table 3.17. Horned larks are presented separately from the other passerine species due to their prevalence in the total sample. In general, passerines were observed flying in the -A [0-26 ft (0-8 m) below the rim] and +A [0-26 ft (0-8 m) above the rim] flight height classes more frequently than at any other heights. Since most observations of flying passerines were of birds moving during local foraging bouts, it would be expected that their flight height would be relatively low. Horned larks were observed more frequently (83%) in the +A flight height class than other passerines (65%). Relatively few passerines fly at the height (+B class) of the proposed wind turbine rotors.

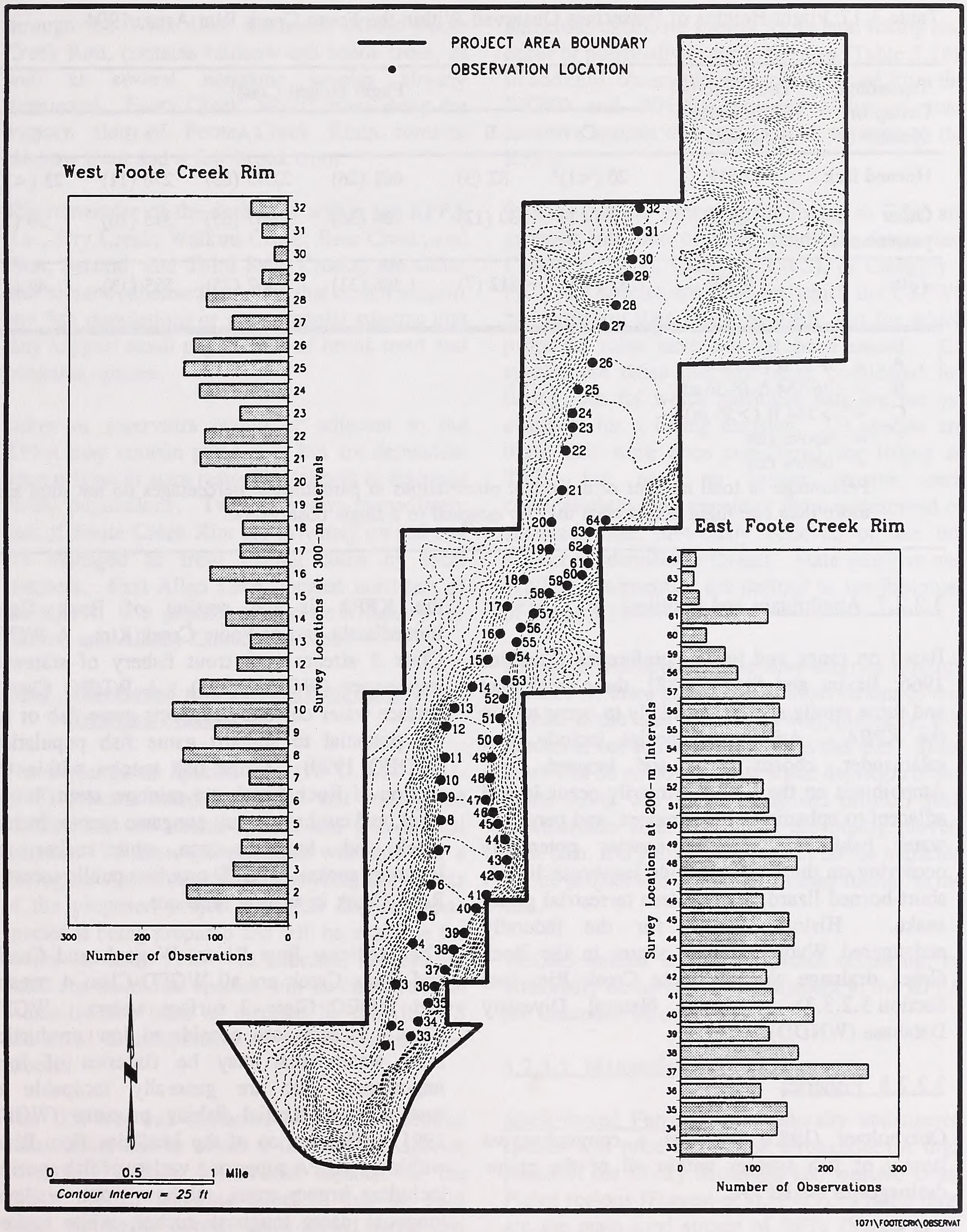


Figure 3.4 Number of Passerines Observed Along the West and East Sides of Foote Creek Rim, March to November 1994.

Table 3.17 Flight Heights of Passerines Observed Within the Foote Creek Rim Area, 1994.

Taxonomic Group or Species	Total Number of Individuals in Sample	Flight Height Class[1]					
		-C	-B	-A	+A	+B	+C
Horned lark	2,511	20 (<1)[2]	82 (3)	661 (26)	2,095 (83)	270 (11)	23 (<1)
Other passerines	1,959	17 (<1)	230 (12)	704 (36)	1,267 (65)	315 (16)	26 (1)
Total	4,470	37 (<1)	312 (7)	1,365 (31)	3,362 (75)	585 (13)	49 (1)

[1] A = 0-26 ft (0-8 m)
B = 26-184 ft (8-56 m)
C = >184 ft (>56 m)
\+ = above rim
\- = below rim

[2] Percentage of total number of individual observations in parentheses; percentages do not total since more than one flight height class may be assigned to a single observation.

3.2.2.7 Amphibians and Reptiles

Based on range and habitat preference (Stebbins 1966; Baxter and Stone 1985), three amphibian and three reptile species are likely to occur within the KPPA. Amphibian species include tiger salamander, chorus frog, and leopard frog. Amphibians on the KPPA primarily occur in and adjacent to ephemeral, intermittent, and perennial water habitats. Reptile species potentially occurring on the KPPA include sagebrush lizard, short-horned lizard, and western terrestrial garter snake. Historic habitat for the federally endangered Wyoming toad occurs in the Rock Creek drainage east of Foote Creek Rim (see Section 3.2.3.3) [Wyoming Natural Diversity Database (WNDD) 1994].

3.2.2.8 Fisheries

Oberholtzer (1985) provides a comprehensive survey of fish species within all of the major drainages in the KPPA.

The only WGFD Class 3 stream (WDEQ Class 2 surface water) within or immediately adjacent to the KPPA is the section of Rock Creek immediately east of Foote Creek Rim. A WGFD Class 3 stream is a trout fishery of statewide importance (WGFD 1991). A WDEQ Class 2 surface water currently supports game fish or has the potential to support game fish populations (WDEQ 1990). Game fish species within this section of Rock Creek are rainbow trout, brown trout, and cutthroat trout; nongame species include creek chub, longnose dace, white sucker, and longnose sucker. WGFD provides public access to Rock Creek in several locations.

The Medicine Bow River, Wagonhound Creek, and Foote Creek are all WGFD Class 4 streams and WDEQ Class 2 surface waters. WGFD Class 4 streams are considered low production trout waters that may be fisheries of local importance, but are generally incapable of sustaining substantial fishing pressure (WGFD 1991). The section of the Medicine Bow River within the KPPA supports a variety of fish species, including brown trout, rainbow trout, walleye, longnose dace, longnose sucker, white sucker, common carp, creek chub, silver shiner, and johnny darter. Wagonhound Creek, which flows

through the Wick Unit southwest of the Foote Creek Rim, contains rainbow and brook trout, as well as several nongame species already mentioned. Foote Creek, which flows along the western side of Foote Creek Rim, contains rainbow trout and a few brook trout.

The remainder of the drainages within the KPPA (i.e., Dry Creek; Watkins Creek; Bear Creek; and First, Second, and Third Sand Creeks) are either intermittent/ephemeral streams that do not support any fish populations or are perennial streams that may support small populations of brook trout and nongame species.

Lakes or reservoirs within or adjacent to the KPPA may contain game fish, but are dependent upon private or state restocking efforts to maintain viable populations. Two reservoirs immediately east of Foote Creek Rim are privately owned and are managed as trout fishing clubs by local ranchers. East Allen Lake, located northeast of the KPPA, is a popular public trout fishery for Carbon and Albany County residents.

3.2.3 Threatened and Endangered/State Sensitive Species

The Endangered Species Act (16 U.S.C. 1531-1543) protects listed threatened and endangered (T&E) plant and animal species and their critical habitats. To ensure compliance with this act, a Biological Assessment (BA) analyzing the effects of the proposed project on T&E and candidate species is being prepared and will be available for review in early 1995. In addition, surveys for T&E and candidate species will be conducted on a case-by-case basis as directed by the USFWS and BLM as components of the pre-construction process.

The USFWS was contacted to initiate informal consultation and to obtain a list of T&E species potentially present within and adjacent to the KPPA. Their response indicated that the bald eagle, peregrine falcon, black-footed ferret and whooping crane are the only T&E species that may occur in or adjacent to the KPPA; however, numerous candidate species for federal listing also occur or potentially occur in the area (Table 3.18). In addition, observation records obtained from the WGFD and WNDD provided a list of state sensitive species that occur on or adjacent to the KPPA.

Species that are proposed for listing as T&E are grouped into one of three candidate categories: Category 1 (C1), Category 2 (C2), or Category 3 (3C). C1 species are those for which the USFWS has sufficient data to list as T&E, but for which proposed rules have not yet been issued. C2 species are those that are being considered for listing, but for which sufficient data are not yet available for a listing decision. C3 species are those that were once considered for listing as T&E, but now no longer receive such consideration; they are either more widespread or abundant than previously believed or are not subject to identifiable threats. State sensitive and WNDD designations are defined in the footnotes of Table 3.18.

Although whooping cranes may migrate through the KPPA, there have been no observations of this species in the area (WGFD 1994a); therefore, this species is not addressed further in this EIS. Since there will be no downstream water depletion of the Platte River due to the proposed project, such downstream T&E species as the piping plover, least tern, and pallid sturgeon will not be impacted by the project and are not addressed further in the EIS.

TEC&S animal and plant species occurring, or potentially occurring, on or adjacent to the KPPA are discussed below.

3.2.3.1 Mammals

Black-footed Ferret. This federally endangered species was once distributed throughout the high plains of the Rocky Mountain and western Great Plains regions (Forrest et al. 1985). Prairie dogs are the main food source of BFFs (Sheets et al. 1972) and few ferrets have been historically collected away from prairie dog colonies (Forrest

Table 3.18 Threatened, Endangered, Candidate, and State Sensitive (TEC&S) Animal and Plant Species Known to Occur or Potentially Occurring Within the KPPA.[1]

Common Name	Location[2]	Date of Last Observation[3]	Status[4]
Mammals			
Black-footed ferret	Several historic observations north and east of FCRA and Alternate 3; most recent probable observation along the southern boundary of the SRA; potential resident of prairie dog colonies within the area	August 1988 (probable)	LE, I-WYGF, S1, G1
Hoary bat	Approximately 2.0 mi (3.2 km) south of the FCRA	May 16, 1992	III-WYGF, S3, G5
Long-legged myotis (bat)	Likely visitor (potential resident) of the KPPA	–	C2, S5?, G5
North American lynx	Approximately 3.0 mi (4.8 km) south of the FCRA	September 26, 1987	C2, III-WYGF, S2, G5
Swift fox	Potential visitor to grassland habitats within the KPPA	–	C2, S3, G4
White-footed mouse	Approximately 4.0 mi (6.4 km) north of the SRA	July 24, 1979	III-WYGF, S3, G5
Birds			
American bittern	Approximately 3.0 mi (4.8 km) northwest of the SRA	July 8, 1985	II-WYGF, S2B, SZN, G4
American white pelican	Numerous observations both within and adjacent to the KPPA	1994	I-WYGF, S1B, S3N, G3
Baird's sparrow	Unlikely summer visitor to the KPPA	–	C2, S2?, G3
Bald eagle	Numerous observations throughout the KPPA; a single active nest within 2.0 mi (3.2 km) of the SRA	1994	LE, S1B, S2N, G3
Bushtit	Two observations along Wagonhound Creek, approximately 4.0 mi (6.4 km) west of the southern FCRA	June 13, 1986	III-WYGF, S3B, SZN, G5
Caspian tern	Two observations approximately 1.0 mi (1.6 km) east of FCR	1994	I-WYGF, S1B, S3N, G5
Ferruginous hawk	Numerous observations throughout the KPPA	1994	C2, III-WYGF, S4B, SZN, G4
Great blue heron	Numerous observations throughout the KPPA	1994	III-WYGF, S4B, S4N, G5
Loggerhead shrike	Several observations throughout FCR	1994	C2, S4B, SZN, G4
Long-billed curlew	Approximately 0.5 mi (0.8 km) south of the SRA	April 17, 1987	3C, III-WYGF, S3B, S4N, G5
Merlin	Several observations along FCR and the southeastern SRA.	1994	II-WYGF, S2, S3B, SZN, G4

Table 3.18 (Continued)

Common Name	Location[2]	Date of Last Observation[3]	Status[4]
Birds (Continued)			
Mountain plover	Numerous observations on top of FCR; plover chicks observed during June and July	1994	C1, S3B, S4N, G3
Northern goshawk	Southern FCR and approximately 1.0 mi (1.6 km) east of FCR	1994	C2, S4B, SZN, G4
Peregrine falcon	Numerous observations along FCR and northwest of the SRA	1994	LE, S1B, S1N, G3T2
Plain titmouse	Several observations along the eastern slope of FCR	1994	III-WYGF, S3B, SZN, G5
Trumpeter swan	Approximately 4.0 mi (6.4 km) east-northeast of the SRA; unlikely migrant through the area	October 23, 1988	C2, I-WYGF, S1, S2B, S2N, G4
Upland sandpiper	Several observations on central and northern FCR	1994	II-WYGF, S2B, S3N, G5
Western burrowing owl	Three observations, two north and one approximately 0.5 mi (0.8 km) south of the SRA	April 27, 1986	C2, II-WYGF, S2, S3B, SZN, G5
Western snowy plover	Potential rare migrant through the KPPA	–	3C, S1, G4?
White-faced ibis	Thirteen observations on and adjacent to FCRA and two observations 2.0-3.0 mi (3.2-4.8 km) northwest of the SRA	1994	C2, I-WYGF, S1B, S2N, G5
Whooping crane	Unlikely migrant through the area	–	LE, SHB, S1N, G1
Amphibians and Reptiles			
Wyoming toad	Possible historic habitat in Rock Creek Drainage east of the FCRA	–	LE, S1, G5T1
Eastern short-horned lizard	Two observations in the SRA and one on FCR	1994	C2, S5, G5
Plants			
Bun milk-vetch	Northern end of Alternate ROWs	June 1920	WYLST 2, S3, G3
Contracted Indian ricegrass	Potential habitat throughout the KPPA	1994	C2, WYLST 2, S2, G4T2
Slender-trumpet ipomopsis	Approximately 3.0 mi (4.8 km) west-southwest of the southern FCRA	August 9, 1993	WYLST 3, S1, G?
Ute lady's tresses	Potential occurrence in wetland areas throughout the KPPA	–	LT, WYLST 1, S1, G2

Table 3.18 (Continued)

[1] WNDD (1993b, 1994); WGFD (1994); Mariah (1994a).
[2] FCRA = Foote Creek Rim Area.
SRA = Simpson Ridge Area.
FCR = Foote Creek Rim.
[3] All observations made in 1994 were part of, or incidental to, raptor and passerine field surveys.
[4] Status definitions as given by the WNDD (1991, 1993a).

Federal Status:

LE = Listed as federally endangered.
LT = Listed as federally threatened.
C1 = USFWS Notice of Review, Category 1. Species for which current information supports the biological appropriateness of proposing to list as endangered or threatened, but proposed rules have not yet been issued.
C2 = USFWS Notice of Review, Category 2. Species for which current information indicates that proposing to list as endangered or threatened is possibly appropriate, but insufficient information is on file to support an immediate ruling.
3C = USFWS Notice of Review, Category 3C. Taxa that were once considered for listing as endangered or threatened, but now no longer receive such consideration. Taxa are more widespread or abundant than previously believed, or are not subject to identifiable threats.

State Status:

I-WYGF = Priority I; includes federally endangered and threatened wildlife. Also includes species in need of immediate attention and active management to ensure that extirpation or a significant decline in the breeding population does not occur.
II-WYGF = Priority II; includes species which are in need of additional study to determine whether intensive management is warranted or whether low-level management (such as monitoring population trends) will suffice. Until intensive management is necessary, low-level management will be implemented.
III-WYGF = Priority III; includes species whose needs should be accommodated in resource management planning. However, intensive management programs to maintain or enhance populations are not warranted at present. Populations of these species should be monitored to determine if low levels of management continue to be adequate. Knowledge of some of these species often is very limited.

WNDD Status:

WYLST 1 = High priority; contains: 1) species that are vulnerable to extinction throughout their range or within Wyoming; 2) federally listed and proposed threatened and endangered species, C1 and C2 candidates, and U.S. Forest Service (USFS) and BLM sensitive species; and 3) species that are regionally rare or significantly disjunct, but which presently have no formal protection status.
WYLST 2 = Medium priority; contains: 1) species on designated watch lists for federal lands, or that are being recommended for watch lists by the WNDD; and 2) other species that are suspected to be moderately rare and/or somewhat threatened globally or regionally.
WYLST 3 = Low priority; contains: 1) species that were previously considered higher priority for protection, but which have been down-ranked as new information has become available; and 2) species that are rare in Wyoming but common and secure in adjacent areas.
S1 = Critically imperiled in Wyoming because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extirpation within the state.
S1B = Statewide breeding status of S1.
S1N = Statewide nonbreeding status of S1.
S2 = Imperiled in Wyoming because of rarity (6 to 20 occurrences or few remaining individuals) or because of some factor(s) making it very vulnerable to extirpation within the state.
S2B = Statewide breeding status of S2.
S2N = Statewide nonbreeding status of S2.
S3 = Rare or uncommon in Wyoming (on the order of 21 to 100 occurrences).
S3B = Statewide breeding status of S3.
S3N = Statewide nonbreeding status of S3.
S4 = Apparently secure in Wyoming with many occurrences.
S4B = Statewide breeding status of S4.
S4N = Statewide nonbreeding status of S4.
SH = Historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to still be extant. Upon verification of an existing occurrence, SH rank elements would typically receive an S1 rank.
SHB = Statewide breeding status of SH.
SZN = Species which are not of significant concern when migrating through or wintering in Wyoming. This includes relatively uncommon migrants in the state with irregular, transitory, or dispersed occurrences. Includes rare species for which important habitats that could be protected are difficult or impossible to define. Also refers to abundant species wintering in, or migrating through, Wyoming.
G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factor(s) making it especially vulnerable to extinction.
G2 = Imperiled globally because of rarity (6 to 20 occurrences) or because of factors demonstrably making it vulnerable to extinction.

Table 3.18 (Continued)

G3	=	Either very rare and local throughout its range, found locally (even abundant at some locations) in a restricted range, or vulnerable to extinction throughout its range.
		G3T2 = Subspecies has G2 status.
G4	=	Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
		G4T2 = Subspecies has G2 status.
G5	=	Demonstrably secure globally and essentially ineradicable under present conditions.
		G5T1 = Subspecies has G1 status.
G?	=	Exact global status unknown.

et al. 1985). BFFs were considered extinct until a small population was discovered near Meeteetse, Wyoming, in 1981. Following outbreaks of canine distemper, surviving ferrets were brought into captivity and a captive breeding program was initiated (USFWS 1988). BFFs were reintroduced in the Shirley Basin region of central Wyoming in 1991; this reintroduction effort continues with the aid of annual supplemental releases.

One probable BFF sighting was reported in August 1988, in an area along the southern border of the Simpson Ridge area (Jobman 1992). This is the most recent potential observation of a BFF within or adjacent to the KPPA. No BFF sightings have been confirmed in the KPPA since the reintroduction of ferrets into Shirley Basin (personal communication, 1993, with Bob Oakleaf, Nongame Coordinator, WGFD). Several historic sightings of BFFs have been recorded in an area north and east of Foote Creek Rim and Alternate 3 (WNDD 1993b, 1994).

Approximately 35% (19,107 ac) of the Simpson Ridge area is classified as BFF PMZ2 (Map 3.9). PMZs are areas designated by the WGFD, BLM, and USFWS to assist in the management of the BFF reintroduction effort (WGFD and BLM 1991). PMZ1 (Shirley Basin) was established as the preferred release site in the Management Area and PMZ2 (Medicine Bow) was designated as a secondary release site. Ferrets have been reintroduced into PMZ1 under an experimental/nonessential designation, and movement outside of the PMZ is anticipated as the ferrets become established and disperse throughout the area. The area south and east of the North Platte River was declared ferret-free prior to the reintroduction of ferrets in Shirley Basin (WGFD and BLM 1991). BFF searches would not be required by the WGFD, BLM, and USFWS within the KPPA due to the experimental/nonessential designation and management guidelines presented in the ferret plan (WGFD and BLM 1991).

Although it is very unlikely that BFFs are present on or near the KPPA, white-tailed prairie dog colonies are scattered throughout the KPPA and adjacent areas and could provide a potential prey base and suitable habitat for ferrets. Prairie dog colonies within the Foote Creek Rim area and along Alternate 3 were mapped in June 1994. Three historic prairie dog colonies encompass approximately 979 ac (20%) of the Foote Creek Rim area; the acreage covered by active prairie dog colonies is smaller. Alternate 3 passes through approximately 6.7 mi (10.7 km) of historic prairie dog colonies (81 ac), some of which are greater than 500 ac in size.

Long-legged Myotis (Bat). This C2 species is one of eight small mouse-eared bats known to occur in Wyoming. Long-legged myotis live throughout the western half of North America and have been reported as the most abundant mouse-eared bat in the western United States (Clark and Stromberg 1987, WGFD 1992). They have been observed in a variety of habitats in Wyoming, including coniferous (e.g., ponderosa pine) and deciduous forests, basin-prairie and mountain-foothills shrublands, and riparian areas. Long-legged myotis nest in tree hollows, snags, buildings, rock crevices, mines, and caves. This species may hibernate in Wyoming during the winter, and is extremely susceptible to disturbance during

hibernation. Long-legged myotis feed exclusively on flying insects, especially moths.

Although long-legged myotis have not been observed in the KPPA, this may, at least in part, be due to the nocturnal activity of this species. It is likely that this bat species occasionally forages over habitats within the KPPA; however, it is unlikely that it is a common resident or visitor in the area.

North American Lynx. A C2 species, North American lynx are found in extensive tracts of high elevation, dense coniferous forests; they favor those containing subalpine fir and Englemann spruce (WGFD 1992). Lynx prey on snowshoe hares, mice, grouse and squirrels, and often occupy areas of heavy winter snow accumulations (Clark and Stromberg 1987).

WGFD records indicate that a lynx was sighted 3 mi south of Foote Creek Rim in 1987, along the edge of the Medicine Bow National Forest. No other lynx sightings have been reported in the area. Because the KPPA lies outside typical lynx habitat, this species is not anticipated to frequent the project area; short duration visits during hunting forays may occasionally occur during winter months.

Swift Fox. The swift fox, a C2 species, is a resident of the northern Great Plains, from the Rocky Mountain foothills to Texas (Clark and Stromberg 1987). In Wyoming, this species inhabits the eastern Great Plains grasslands, occasionally utilizing agricultural lands and irrigated native meadows. Prey items include small mammals, insects, and birds (WGFD 1992).

No recent sightings of swift fox have been reported on or near the KPPA. However, much of the KPPA is potential swift fox habitat. Swift fox may, at least infrequently, use the KPPA and adjacent areas.

State Sensitive Species. Two state sensitive mammal species have been observed in the vicinity of the KPPA: hoary bat and white-footed mouse.

The relatively large hoary bat inhabits greasewood flats, shortgrass prairies, and aspen/pine forests (Clark and Stromberg 1987). Although this bat has been observed throughout the state, the overall rarity of observations has resulted in a poor understanding of the biology of this species. A hoary bat was observed about 2 mi (3 km) south of Foote Creek Rim in 1992 (WGFD 1994b), and it is likely that this species occurs within the KPPA during the summer months.

A white-footed mouse was collected approximately 4 mi (6 km) north of the Simpson Ridge area in 1979 (WGFD 1994b). This mouse species generally occurs east of the Rocky Mountains (Burt and Grossenheider 1976, Clark and Stromberg 1987); it is at the western extreme of its range in the vicinity of the KPPA. White-footed mice inhabit deciduous woodlands and associated riparian habitats (Clark and Stromberg 1987). Although it is probably not a common species in the vicinity of the KPPA, it may occur along such wooded drainages as the Medicine Bow River and Rock Creek.

3.2.3.2 Birds

Bald Eagle. Bald eagles are a federally endangered species which require cliffs, large trees, or sheltered canyons associated with concentrated food sources (e.g., fisheries or waterfowl concentration areas) for nesting and/or roosting areas (Edwards 1969, Snow 1973, Call 1978, Steenhof 1978, Peterson 1986). Bald eagles may be downlisted to a federally threatened status in 1995. Bald eagles forage widely during the non-nesting season (i.e., fall and winter) and scavenge on animal carcasses such as deer and elk.

During 1994, one active bald eagle nest was documented approximately 2 mi (3 km) south of

the Simpson Ridge area. It is located approximately 5 mi (8 km) northwest of Elk Mountain, Wyoming, and is visible from I-80. One immature bald eagle successfully fledged from this nest in 1994.

Bald eagles have been observed throughout the KPPA (Mariah 1994a, WGFD 1994b). Thirty-six bald eagle observations occurred within the Foote Creek Rim area during raptor and passerine surveys conducted between March and November 1994. Twenty-two of the observations (61%) were immature bald eagles, while the remaining 14 observations (39%) were adults. No portion of the rim was excluded from use by bald eagles, although bald eagle observations were most common in the western and northern portions of the rim. Twenty-four (67%) of the bald eagle observations occurred either over or immediately adjacent to the top of Foote Creek Rim; eight of the remaining nine observations occurred within 0.1 mi (0.2 km) of the rim.

Twelve bald eagle observations occurred within the Simpson Ridge area; eight of these were adult birds (75%) and four were juveniles (25%). Eight of these observations were of immature (1) and adult (7) bald eagles immediately south of I-80 on the southern boundary of the Simpson Ridge area. Two immature bald eagles were observed in the northern portion of the Simpson Ridge area. Five (42%) of the bald eagle observations occurred between September 1 and November 30, 1994.

Although bald eagles apparently did not nest within the KPPA during 1994, it is likely that they use the area for foraging throughout the year. No communal winter bald eagle roosts are known to occur within the KPPA, but it is likely that cottonwood trees along the Medicine Bow River, Rock Creek, Foote Creek, and other perennial drainages within the area are regularly used as perches in the winter (personal communication, June 1994, with Bob Oakleaf, Nongame Coordinator, WGFD). Wintering bald eagles are known to feed on road-killed deer in the area (personal communication, 1993, with Bob Oakleaf, Nongame Coordinator, WGFD), and the Rock Creek drainage east of Foote Creek Rim may also serve as a bald eagle wintering site.

<u>Peregrine Falcon</u>. A federally endangered species, peregrine falcons nest on tall cliffs, usually within 1.0 mi (1.6 km) of a stream, river, or extensive brush or woodlands, these habitats provide concentrated food sources and open areas to hunt (Call 1978, Snow 1972). Peregrine falcons nest on substantial rock outcrops (usually southern exposure) in small caves or on overhanging ledges large enough to accommodate three to four full-grown nestlings (Wilderness Research Institute 1979). Peregrine falcons feed almost exclusively on birds, many of which are associated with riparian zones and large bodies of water (i.e., waterfowl).

While no known peregrine falcon nests were observed in the 1994 nesting survey area, peregrine falcons have been observed within the KPPA. WGFD personnel reported two sightings of peregrine falcons 5 mi (8 km) northwest of the Simpson Ridge area in June of 1983 (WGFD 1994b). Twenty-seven observations of peregrine falcons occurred in the Foote Creek Rim area between March 9 and November 30, 1994; the majority of these observations (22, or 77%) occurred between July 19 and October 3, 1994. Although peregrine falcons were observed along the length of the rim, approximately 56% of these observations (15) were along the western side of the rim. Seventeen observations (65%) occurred directly over the rim, and another 7 (26%) occurred within 328 ft (100 m) of the rim edge. Peregrine falcons were generally observed at relatively discrete locations along the rim; these may be areas where falcons move across the rim to access either slope (Map 3.16). Three peregrine falcon observations were observed within the Simpson Ridge area during avian surveys in August 1994.

It is possible, due to the relatively large number of observations throughout the spring and summer, that peregrine falcons nest within or immediately adjacent to the KPPA. However, no peregrine falcon nests were found during the 1994 raptor

nest survey, and the availability of suitable nesting cliffs in the area is limited. Also, no peregrine falcon nest records occur in the WGFD Wildlife Observation System database for the KPPA or surrounding region (WGFD 1994b).

The KPPA, and especially Foote Creek Rim, is occasionally used for hunting by peregrine falcons; several ponds and lakes immediately east of Foote Creek Rim provide an abundant source of potential waterfowl and shorebird prey. It is likely that wintering or migrating peregrine falcons also use the KPPA on occasion.

Mountain Plover. The mountain plover is a C1 species inhabiting the high, dry shortgrass plains east of the Rocky Mountains (Dinsmore 1983). The focus of breeding activity appears to be southeastern Wyoming and eastern Colorado (Graul and Webster 1976). Graul and Webster (1976) noted that mountain plover nesting habitat is associated with blue grama and buffalo grass, although any short grass, very short shrub (e.g., saltbrush), or cushion plant type could be considered nesting habitat. Breeding bird surveys between 1966 and 1987 show an overall decline in the continental population of mountain plovers (USFS 1994a). Surveys completed in 1991 indicate that only 4,360 to 5,610 mountain plovers remain on the North American continent (USFS 1994b). Loss of breeding habitat due to cultivation and prey base declines resulting from pesticide use are major threats to mountain plover survival (Wiens and Dyer 1975).

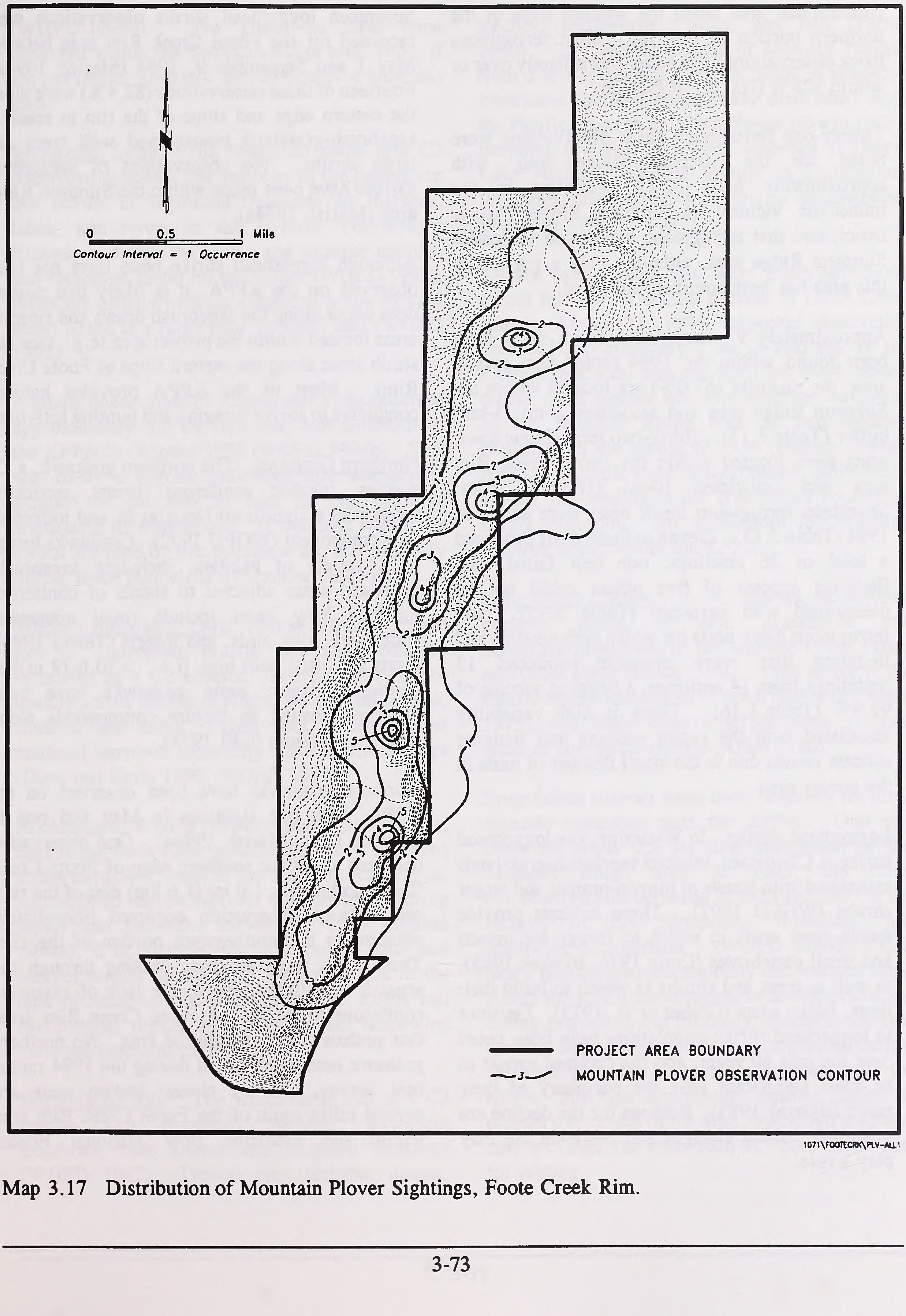
While mountain plovers have not been observed on the Simpson Ridge area, they were routinely observed throughout early and mid-summer on top of Foote Creek Rim in 1994. Two hundred thirty-four observations of mountain plovers, representing approximately 15-20 breeding pairs, were recorded on Foote Creek Rim during the spring and summer of 1994 (Mariah 1994a). One nest was located during 1994, and all three eggs successfully hatched in mid-July; most observations in mid-summer were of adults with chicks of various ages. Habitat on top of Foote Creek Rim is monotypic, shortgrass prairie, which would suggest a random, area-wide plover distribution. Observations, however, indicate that plovers show a preference for the eastern (leeward) side of Foote Creek Rim (Map 3.17); an average of 5.6 plover observations per survey was recorded for the eastern side compared to 1.1 plover observations per survey on the western side for the ten survey periods between May 24 and July 26, 1994 (date of last observation). The majority (54%) of mountain plover flight observations were at heights between 0 and 26 ft (0-8 m) above the rim; approximately 26% (3 observations) were at proposed wind turbine rotor levels [i.e., 26-184 ft (8-56 m)].

Baird's Sparrow. This C2 species is a common summer resident of the upper Great Plains states (Scott 1987). The Baird's sparrow is rare in Wyoming; it is most likely to occur along the eastern edge of the state, where it prefers mid- to tallgrass prairie and hay meadows (Dorn and Dorn 1990, WGFD 1992).

Baird's sparrows have not been observed within or adjacent to the KPPA. However, since this species has been occasionally observed in the shortgrass prairies of eastern Wyoming, it should be considered an unlikely summer visitor to the KPPA. Any Baird's sparrows observed within the KPPA would probably be vagrant individuals temporarily feeding and resting in the area.

Ferruginous Hawk. The ferruginous hawk is a C2 species that breeds in semi-arid plains and intermountain areas of the Great Basin and Great Plains (Evans 1983). This species often nests on low cliffs, buttes, and cutbanks (Call 1978), as well as in junipers or sagebrush along the edges of pinyon-juniper communities. Ferruginous hawks feed primarily on small to medium-sized mammals such as jackrabbits, cottontail rabbits, ground squirrels and prairie dogs (Sherrod 1978).

One hundred ninety-eight observations of ferruginous hawks occurred on the Foote Creek Rim area between March 16 and November 30, 1994 (Mariah 1994a). Many of these observations were of juvenile birds soaring in a relatively



Map 3.17 Distribution of Mountain Plover Sightings, Foote Creek Rim.

concentrated area along the western edge of the northern portion of the rim. Most ferruginous hawk observations were either immediately over or within 328 ft (100 m) of the rim.

Twenty-one ferruginous hawk observations were noted for the Simpson Ridge area, with approximately half (52%) occurring in the immediate vicinity of Simpson Ridge. It is anticipated that ferruginous hawks use the entire Simpson Ridge area, although only a portion of this area has been routinely surveyed.

Approximately 97 ferruginous hawk nests have been found within the 1994 raptor nest survey area; the majority (67.0%) are located within the Simpson Ridge area and associated 2-mi (3-km) buffer (Table 3.13). Thirty-two ferruginous hawk nests were located within the Foote Creek Rim area and associated 10-mi (16-km) buffer. Seventeen ferruginous hawk nests were active in 1994 (Table 3.13). Eleven of these nests produced a total of 26 nestlings; one nest failed, and fledgling success of five others could not be determined with certainty (Table 3.15). Six ferruginous hawk nests for which both nestling and fledgling data were available produced 13 fledglings from 14 nestlings, a fledging success of 92.9% (Table 3.16). There is high variability associated with the raptor nestling and fledging success results due to the small number of nests in the survey area.

Loggerhead Shrike. In Wyoming, the loggerhead shrike, a C2 species, inhabits sagebrush-grasslands associated with stands of pinyon-juniper and larger shrubs (WGFD 1992). These habitats provide ample open areas in which to forage for insects and small vertebrates (Craig 1978, Bystrak 1983), as well as trees and shrubs in which to build their large, bulky nests (Graber et al. 1973). Declines in loggerhead shrike populations have been noted over the past 40 years, and the declines appear to be most significant near the periphery of their range (Bystrak 1983). Reasons for the decline are unknown; habitat changes and pesticide use may play a role.

Seventeen loggerhead shrike observations were recorded for the Foote Creek Rim area between May 1 and September 9, 1994 (Mariah 1994a). Fourteen of these observations (82.4%) were along the eastern edge and slope of the rim in areas of sagebrush-grassland interspersed with trees and large shrubs. No observations of loggerhead shrikes have been made within the Simpson Ridge area (Mariah 1994a).

Although loggerhead shrike nests have not been observed on the KPPA, it is likely that nesting does occur along the sagebrush draws and riparian areas located within the project area (e.g., tree and shrub areas along the eastern slope of Foote Creek Rim). Most of the KPPA provides habitats conducive to shrike foraging and hunting activities.

Northern Goshawk. The northern goshawk, a C2 species, inhabits coniferous forests, especially those with a significant Douglas fir and lodgepole pine component (WGFD 1992). Goshawks forage in a variety of habitats, including sagebrush-grassland areas adjacent to stands of coniferous forest. Prey items include small mammals, waterfowl, song birds, and insects (Terres 1980). Nests are often built high [i.e., >30 ft (9 m)] in coniferous trees; some goshawks have been observed nesting in mature cottonwoods along riparian corridors (Call 1978).

Northern goshawks have been observed on the KPPA, with two sightings in May and one in October 1994 (Mariah 1994a). One observation occurred along the southern edge of Foote Creek Rim; another was 1.0 mi (1.6 km) east of the rim; and a third observation occurred immediately adjacent to the southeastern portion of the rim. These birds were probably hunting through the area; it is unlikely, due to the lack of extensive coniferous forest on the Foote Creek Rim area, that goshawks nest within the area. No northern goshawk nests were found during the 1994 raptor nest survey, and the closest known nests are several miles south of the Foote Creek Rim area within the Medicine Bow National Forest

(WGFD 1994b). No goshawks have been observed within the Simpson Ridge area; little, if any, potential goshawk habitat occurs within this area.

Trumpeter Swan. The trumpeter swan is a C2 waterfowl species. The majority of the population that occurs in Wyoming frequents the marshes, lakes, and rivers in the Greater Yellowstone Ecosystem during the spring and summer months, and returns to Idaho for the winter (WGFD 1992). Nests are usually built on a muskrat house or very small island in a large pond or small lake (WGFD 1992).

A single observation of a trumpeter swan occurred approximately 4.0 mi (6.4 km) east-northeast of the KPPA in October 1993 (WGFD 1994b). This was likely a vagrant individual that temporarily stopped in the area to feed or rest prior to continuing its wanderings. If wetlands within the KPPA are used by this species at all, it is probably during these rare visits by transient individuals.

Western Burrowing Owl. This small, long-legged owl of shortgrass prairie has been recently identified as a C2 species. Burrowing owls are usually active during daylight, feeding on insects, rodents, and birds. They nest in unoccupied mammal burrows, especially those of prairie dogs (Dorn and Dorn 1990, WGFD 1992).

According to WGFD (1994b) observation records, burrowing owls have occasionally been observed to the north and south of the Simpson Ridge area. Although no burrowing owls were observed during raptor and passerine surveys in 1994 (Mariah 1994a), it is possible that this species nests and forages within the KPPA. However, due to the lack of recorded observations for the KPPA and surrounding region, it is unlikely that burrowing owls are common in the area.

White-faced Ibis. The white-faced ibis is a C2 species that frequents marshes, wet-moist meadows, lake shores and irrigated meadows (WGFD 1992). Typical prey includes insects, leeches, earthworms, frogs, and fish (Terres 1980). The species breeds in colonies ranging from a few to several thousand birds in extensive freshwater marshes sporadically distributed from the Pacific Coast to the Great Plains (Erwin 1983). Breeding colonies have been observed at Hutton Lake National Wildlife Refuge in southeastern Wyoming and several locations in southwestern Wyoming (WGFD 1992).

Twelve white-faced ibis were observed flying across the narrow central portion of Foote Creek Rim on March 31, 1994. Another observation occurred approximately 2 mi (3 km) east of the Foote Creek Rim area on April 14, 1994, near a creek. This species was also observed northwest of the Simpson Ridge area on two separate occasions in the spring of 1994 (Mariah 1994a). All of these birds were likely transient individuals, resting and feeding in the area before continuing spring migration. No white-faced ibis breeding colonies occur within the KPPA.

Long-billed Curlew. A 3C species, long-billed curlews breed in arid grasslands and sagebrush/grasslands of the western Great Plains and Great Basin (Howe 1983). They arrive in the central Rocky Mountains in April (Behle and Perry 1975), and build shallow scrape nests in open areas of shortgrass prairie (Allen 1980).

Long-billed curlews have been observed on three separate occasions near the KPPA. One was observed about 0.5 mi (0.8 km) south of the Simpson Ridge area in 1983; the other two observations occurred in 1985 and 1987 in the vicinity of Elk Mountain, Wyoming, just southwest of Alternate 1 (WGFD 1994b). It is likely that curlews occasionally use wetland areas within the KPPA for foraging or as stopover areas during migration, but probably remain in the area for only short periods of time. Long-billed curlew nesting activity has never been documented for the KPPA, although appropriate nesting habitat is present over much of the area. Although unlikely, curlews could use areas such as Foote Creek Rim for nesting.

Western Snowy Plover. The western snowy plover, a 3C species, summers in states south and west of Wyoming (i.e., Utah, Nevada, California, and Oregon) (Scott 1987). This species feeds on insects and other invertebrates along the shores and sandy beaches of alkaline ponds (Dorn and Dorn 1990, WGFD 1992). Western snowy plovers have only been occasionally observed in Wyoming, and most of these observations have occurred in southwestern Wyoming (WGFD 1992).

No western snowy plovers have not been observed within or adjacent to the KPPA (Mariah 1994a, WGFD 1994b). This species is unlikely to occur within the KPPA except as a rare summer migrant through the area.

State Sensitive Species. Nine state sensitive bird species occur, or potentially occur, within or adjacent to the KPPA: American bittern, American white pelican, burrowing owl, bushtit, Caspian tern, great blue heron, merlin, plain titmouse, and upland sandpiper (WGFD 1994b).

Four species (i.e., American bittern, American white pelican, Caspian tern, and great blue heron) frequent ponds, lakes, rivers, and wetland areas within the state (WGFD 1992). Although all four of these species may occasionally pass through the KPPA during migration or while foraging, only the American white pelican, Caspian tern, and great blue heron were observed in the area in 1994. All three of these species were observed at the reservoir and wetland areas immediately east of the Foote Creek Rim area. Thirty-six of 55 observations (65.5%) of American white pelicans and nine of 25 observations (36.0%) of great blue herons were of birds flying over or immediately adjacent to Foote Creek Rim. Two observations of Caspian terns occurred over lakes immediately east of Foote Creek Rim. Between April and November 1994, American white pelicans and great blue herons were also observed within the Simpson Ridge area.

Twelve observations of merlin, small falcons that often nest in mature cottonwood riparian zones, were noted within the Foote Creek Rim area between February 16 and November 30, 1994 (Mariah 1994a). Nine of the observations (75%) occurred in October and November. All 12 observations involved merlin flying over or within 164 ft (50 m) of the top of the rim. Nesting habitat for this species likely occurs within the Rock Creek drainage east of the rim, but no merlin nests were found during ground surveys. Three observations of merlin have been recorded within the Simpson Ridge area; all three occurred at the southeastern tip of Simpson Ridge.

Seven observations of upland sandpiper occurred in the Foote Creek Rim area between May 5 and 17, 1994. Most observations were in the central portion of the rim, away from the edges. Foote Creek Rim, with its monotypic shortgrass prairie, provides appropriate nesting habitat for upland sandpipers, which build their nest in a shallow depression on open ground (WGFD 1992). Although several of the upland sandpiper observations on Foote Creek Rim involved displaying birds, none were observed to nest in the area. No upland sandpipers were seen in the Simpson Ridge area.

Bushtits and plain titmice have both been observed in the vicinity of the KPPA (Mariah 1994a, WGFD 1994b). Both species prefer riparian habitats with significant shrub cover, such as is found along the Medicine Bow River and Rock Creek drainages. In June and July 1994, plain titmice were observed nine times along the shrub-covered eastern edge of central Foote Creek Rim (Mariah 1994a).

3.2.3.3 Amphibians and Reptiles

Wyoming Toad. The Wyoming toad is a federally endangered species found exclusively in the Laramie Basin of southwestern Wyoming (Baxter and Stone 1985). Habitat for this species includes floodplains, ponds, and small seepage lakes within shortgrass prairie communities, where it feeds on a variety of ants, beetles, and other arthropods (Baxter and Stone 1985). Currently, the Wyoming toad is found in isolated populations at Mortenson

Lake near Laramie, Wyoming, and Lake George near Hutton Lake in the Hutton Lake National Wildlife Refuge. A Wyoming toad captive breeding program, supervised by the WGFD, is underway at Sybille Wildlife Research and Conservation Education Unit north of Laramie, Wyoming.

No Wyoming toads have been observed within or adjacent to the KPPA, and the likelihood of their appearance within the area is extremely low. Historic Wyoming toad habitat occurs east of Foote Creek Rim, and includes portions of the Rock Creek drainage (WNDD 1993b). Many of these areas were searched in 1980, 1983, and 1991, but no toads were found during these surveys (WNDD 1993b). A series of intensive searches in the Laramie Basin [i.e., 20 mi (32 km) east of the KPPA] during the spring and summer of 1994 failed to find any Wyoming toads [Western EcoSystems Technology, Inc. (WEST) 1994].

Eastern Short-horned Lizard. A C2 species, the eastern short-horned lizard is found throughout most of Wyoming below about 6,500 ft (1,981 m); it is especially common in sagebrush-grassland communities in the central and southwestern counties of the state (Baxter and Stone 1985). Short-horned lizards favor area with firm soils that are relatively flat and arid (Baxter and Stone 1985). These ground dwellers forage diurnally, primarily feeding on ants and beetles, and bear their young live in relatively large litters (Baxter and Stone 1985).

Eastern short-horned lizards have been observed within both the Simpson Ridge (two observations) and Foote Creek Rim (one observation) areas (Mariah 1994a). It is probably a relatively common resident of sagebrush-grassland and shortgrass habitats within the KPPA.

3.2.3.4 Plants

Ute Lady's Tresses. This federally threatened member of the orchid family was first identified in Wyoming in August 1993 (BLM 1994b). Although the Ute lady's tresses has only been found in Goshen County (i.e., eastern Wyoming), it is suspected to occur throughout appropriate habitats in southern Wyoming (BLM 1994b). This species grows along streams, rivers, ponds, reservoirs, as well as in bogs and wetland, riparian, or seepage areas. These habitats do occur within the KPPA, and will be avoided where feasible; areas to be disturbed within these habitats will be surveyed for this plant prior to construction.

Contracted Indian Ricegrass. Contracted Indian ricegrass, a C2 species, potentially occurs within the KPPA. This species flourishes on dry slopes at medium elevations in deserts and plains, usually in deep, sandy soil (Hitchcock 1971, Beetle 1977). Although much of the KPPA meets the necessary habitat requirements of contracted Indian ricegrass (personal communication, 1993, with Connie Breckenridge, BLM), an initial plant survey in 1994 did not reveal its presence in the area.

State Sensitive Species. Two state sensitive species, bun milk-vetch and slender-trumpet ipomopsis, have been found in areas adjacent to the KPPA (WNDD 1993b, 1994). Bun milk-vetch is a plant which inhabits bare slopes and ridges (Dorn 1992); this type of habitat occurs over much of the KPPA. The ipomopsis, on the other hand, prefers relatively moist hills, slopes, and woods (Dorn 1992). This habitat type is more likely to occur south of the KPPA (i.e., within and adjacent to the Medicine Bow National Forest) than within the project area itself.

3.3 CULTURAL RESOURCES

Cultural resources, which are protected under the National Historic Preservation Act of 1966 and the Archaeological Resources Protection Act of 1979, are the nonrenewable remains of past human activity. The archaeological record of the KPPA has been partially examined through surveys, test excavations, ethnographic materials regarding extant Native American populations, and historic documents pertaining to the settlement and use of the area by Euro-Americans.

A file search (No. 12931) performed by the SHPO for KPPA lands indicates that numerous small-scale cultural resource inventories have been conducted in the KPPA, covering more than 4,000 ac. The majority of the surveys were linear and conducted for pipelines and power lines. A Class III survey and site testing were completed on top of Foote Creek Rim in the spring of 1994, and the Class III report is on file at the SHPO office. A Class III survey for Alternate 3 was completed in the summer of 1994, and the Class III report is on file at the SHPO office. To date, only Class I file searches have been completed for Simpson Ridge and Alternates 1 and 2. Information from these inventories and record searches provides estimates of the nature and density of prehistoric and historic resources within the KPPA.

One hundred twenty-four prehistoric, historic, and multicomponent (consisting of both prehistoric and historic components) sites have been recorded within and adjacent to the KPPA. A majority of these sites were recorded as the result of numerous small surveys which have occurred within the project area. No protohistoric sites, which represent the period when European influences began to have a major effect on Native American lifeways, are known from the project area. Consultation with Native American tribes known to have used the project area indicates that religious or culturally important sites occur in the area. The Northern Arapaho, Northern Cheyenne, and Eastern Shoshone were the primary Native American groups that used the KPPA (Garbarino 1976). Table 3.19 provides a summary of cultural resource sites within the KPPA and their eligibility for the NRHP.

Twenty cultural resource sites occur on the Foote Creek Rim area, including four prehistoric sites, 14 multicomponent sites, and two historic sites. The area has recently been designated the Foote Creek Rim Archaeological District by the BLM. The sites are composed of a total of 564 stone cairns, circles, arcs, and various alignments located along the eastern and western edges of the rim and on the summit and slopes of Arlington Peak. Seventeen cultural resource sites occur within the Alternate 3 ROW, including two prehistoric sites, four multicomponent sites, and 11 historic sites. The sites are discussed in detail in Sections 3.3.1-3.3.3.

The BLM has consulted with Native American tribes that may have sites of religious or cultural importance in the area. Representatives of several tribes have indicated that certain rock features recorded within the Foote Creek Rim Archaeological District have historic ties to their tribes. Due to the possible spiritual nature of these features, their significance and locations are confidential.

However, in order to fully evaluate the importance of these stone features to the regional Native American tribes, an ethnographic study that will document the historical connections between the tribes and specific features and/or activities has been initiated. If these connections are indeed present, and the tribes allow the ethnohistorian to record them, then the Foote Creek Rim Archaeological District may be eligible for the NRHP under both Criteria A and D. Cultural properties may be eligible under Criterion A if they are associated with events that have made a significant contribution to the broad patterns of history. Under Criterion A, the setting in which archaeological remains occur is an important component of its integrity. Therefore, turbine erection may adversely affect the site's eligibility under this criterion.

3.3.1 Prehistoric Resources

The Northwestern Plains appear to have been inhabited by aboriginal hunting and gathering peoples for over 11,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. A chronological framework pertinent to the project area has been established for the Northwestern Plains, based mostly on artifact typology (primarily projectile points). Period names are based on Frison's (1978) modification of Mulloy's (1958) framework for Northwestern Plains prehistory.

Table 3.19 Summary of Cultural Resource Sites Within the KPPA.

Site	Foote Creek Rim Area[1]	Simpson Ridge Area[2]	Alternate 1[2]	Alternate 2[2]	Alternate 3[1]	Total
Prehistoric						
Listed	--	1	--	--	--	1
Eligible	--	2	1	8	--	11
Potentially eligible	2	--	--	--	--	2
Ineligible	--	4	9	17	2	32
Undetermined	--	3	6	1	--	10
Multicomponent						
Eligible	--	--	--	--	--	--
Potentially eligible	16	--	--	--	--	16
Ineligible	--	1	--	--	4	5
Undetermined	--	--	1	--	--	1
Historic						
Eligible	--	--	5	4	3	12
Potentially eligible	1	--	--	--	--	1
Ineligible	1	2	6	2	8	19
Undetermined	--	2	1	4	--	7
Total	20	15	29	36	17	117

[1] Class I and Class III completed.
[2] Only Class I completed.

The PaleoIndian Period is associated with big game hunting, and includes a series of cultural complexes identified by distinctive large projectile points which are often associated with the remains of large, now extinct, mammals (mammoth, bison, camel, and other megafauna). The early Archaic Period is characterized by a range of smaller side-notched, stemmed, or corner-notched projectile points reflecting the exploitation of a broader spectrum of animal resources, with a much diminished utilization of large mammals. Groundstone tools are common, indicating the importance of wild plant resources, and animals exploited were primarily small mammals such as jackrabbit, cottontail rabbit, and ground squirrel. The Middle Archaic Period is characterized by a variety of indented base, stemmed, or lanceolate projectile points. Generally, in southern Wyoming, this period is characterized by a mixed hunting/plant-gathering economy with a reliance on large mammals other than bison (Wheeler et al. 1986).

The Late Archaic Period is characterized by medium to large corner-notched projectile points. Subsistence patterns of the Late Archaic Period are less well-documented than for succeeding and preceding periods in southern Wyoming. Bison and pronghorn appear to have been the primary animals exploited during this period, although smaller animals were used at some sites. Except for the recovery of groundstone implements at a few sites, little information exists concerning the utilization of plant resources in Wyoming. The only components from this phase which have produced significant quantities of charred seeds are from the Taliaferro Site in Lincoln County, Wyoming (Smith and Creasman 1988).

The Late Prehistoric represents a period of intensified occupation throughout the region. There is a general switch from a reliance on dart-based hunting technology to the use of the bow and arrow at the beginning of this period. Most Late Prehistoric period sites in southern Wyoming are identified by Rose Spring corner-notched projectile points, small side-notched arrow points, and occasional ceramics. Ceramics, although not common, are generally Fremont types (Bower et al. 1986; Greer and Greer 1989). Intermountain ceramics are also diagnostic for the period. Numerous sites of the Late Prehistoric Period in Wyoming reflect bison kill or processing activities (Frison 1973, 1978; Latady et al. 1984).

There are 56 prehistoric sites within the KPPA. Site types include open camp/rockshelters, stone circles, rock alignments, open camps, and lithic scatters. The Garret Allen Site is the only site within the KPPA that is listed on the NRHP. Four prehistoric sites have been recorded on the Foote Creek Rim area and are composed of rock cairns, circles, arcs, and alignments. The function of these features will be determined through evaluation of the archaeological remains and Native American consultation. Eligibility determinations have not been made for the prehistoric sites due to the on-going National Register evaluations. Eligibility determinations will be included in the FEIS for this project.

Two prehistoric sites have been recorded within the Alternate 3 ROW. Both sites are lithic scatters of limited quantity and diversity and are ineligible for inclusion in the National Register of Historic Places (NRHP).

Eligibility determinations have not yet been made for the prehistoric sites and prehistoric components of multicomponent sites within the Foote Creek Rim Archaeological District. The historic sites, including each of the historic components of the multicomponent sites also have undetermined eligibility at this time. Eligibility determinations will be included in the FEIS.

3.3.2 Historical Resources

According to Massey's (1990) chronological framework for Wyoming history, historical land use of the project area extends with certainty back to the Pre-territorial Period (1842-1868), and continues forward through the Modern Period (1939-Present). In addition, historic land use of the KPPA by Native American groups such as the Northern Arapaho has been documented (personal

communication, November 1994, with Gary DeMarcay, Archaeologist, BLM). Historic contexts pertinent or potentially pertinent to the KPPA include transportation and communication, military, coal mining, ranching (cattle and sheep), and oil and gas exploration/extraction.

American westward expansion, beginning with the California Gold Rush in 1849, initiated the utilization of southern Wyoming, including the vicinity of the KPPA, as a transportation corridor for westward migration and stage traffic between dispersed urban centers. A major historic road, the Overland Trail, passes to the south of the Simpson Ridge area, and coincides with the southern boundary of the Foote Creek Rim area (now superseded by I-80). The Overland Trail passes twice through Alternate 1. The route which became known as the Cherokee or Overland Trail was blazed as early as 1825 by a party of fur trappers with William Ashley of the Rocky Mountain Fur Company, and was used in 1843 by John C. Fremont on his second expedition to the West. The next documented use of the trail was in 1849 by a group of westward bound Cherokee prospectors. Regular use of the trail began in the early 1860s, when it was improved and utilized as a mail, passenger, and freight road by the Overland Stage Company, linking Denver and Salt Lake City. This use persisted until the late 1860s, when a federally subsidized transcontinental railroad was completed across southern Wyoming, rendering the stage service obsolete. The Overland Trail, however, remained in use as a thoroughfare for emigrant traffic, probably into the twentieth century (Thybony et al. 1985).

The federal government responded to the threat of Indian attacks on traffic along the Overland Trail by establishing military posts at strategic locations and quartering small detachments of soldiers at stage stations. One such garrison (Fort Halleck) was established in July 1862, at the northern base of Elk Mountain, 1.0 mi (1.6 km) east of Elk Mountain Stage Station. This army installation was abandoned in July 1866.

The Union Pacific (UP) Railroad, laying track westward from Omaha, was responsible for building the line across what is now Wyoming during 1867-1868. The mainline originally passed through the center of the Simpson Ridge area, with stations at Carbon and Percy. The mainline was realigned around 1900 and moved several miles to the north to its present alignment. The original UP line also crossed all three alternate transmission line routes. The stations of Carbon and Percy were abandoned, as was the original, circuitous, railroad grade through the Simpson Ridge area. A portion of the active UP line presently traverses the northern tip of the Simpson Ridge area.

The route of the transcontinental railroad was determined, in part, by the location of coal deposits capable of supplying locomotive fuel, and the Simpson Ridge portion of the project area was historically a locus of this activity. The earliest coal mining town in Wyoming Territory was established in 1868 by the Wyoming Coal and Mining Company at Carbon. Later the UP Coal Company, a UP Railroad subsidiary, assumed control of the coal mines in Carbon. A total of seven mines yielding over 4.6 million tons (4.2 million metric tons) was opened here between 1868 and 1902, when they were closed (Gardner and Flores 1989). In 1889, the UP Coal Company developed mines and a company town at Hanna, located just northwest of the Simpson Ridge area. Hanna operated continuously until 1954, when the mines were closed due to the reduced demand associated with the UP Railroad's switch from steam to diesel locomotives. The Hanna mines were revived in the early 1970s as demand for Wyoming coal increased (Gardner and Flores 1989). Mines and mining-related sites occur within the Simpson Ridge area, and at least one potentially historic mining locality, the Black Diamond Coal Mines (near Hanna), is located within the Alternate 2 ROW.

Another major industry established after the coming of the railroad was ranching. Both cattle

and sheep were grazed on the range by the 1880s, although the severe winters of 1886 and 1887 caused a sharp decline in the cattle population and allowed the expansion of sheep husbandry. Stock raisers settled in the KPPA, as well as throughout Wyoming, by obtaining title to government lands under a series of homestead laws. Historic ranches were established in the Simpson Ridge area, as well as in proximity to Alternate 2. Cattle ranching required large expanses of grazing land, and resulted in a dispersed settlement pattern of isolated ranches linked to main thoroughfares by a network of dirt roads. Many of these early local and regional transportation routes occur within the KPPA, particularly in the Simpson Ridge area and alternate transmission line corridors. Stock raising has continued to be an important land use in the project area through the present.

In the twentieth century, oil exploration and recovery activities were conducted within the KPPA. Spurred by the development of motorized transportation reliant upon petroleum-based fuels, as well as by heightened military demand in World War I and postwar prosperity, Wyoming experienced an oil boom in the late 1910s and 1920s. Among the many oil fields developed in the state was Simpson Ridge, where production began in 1923. Oil from Simpson Ridge was transported by pipeline to Hanna (Espach and Nichols 1941).

Within the KPPA, 39 historic sites are recorded in existing BLM and SHPO files. Additional historic sites were recorded during Class III inventories of the Foote Creek Rim area and Alternate 3. Most historic sites recorded in the area represent debris scatters of probable sheepherder camps and energy exploration related activities. The Rock Creek Stage Station, which is adjacent to the KPPA, is listed on the NRHP. Sites eligible for NRHP listing include a bridge, a cemetery, two mines, the town of Hanna, a rock inscription, an oil camp, and the Overland Trail. Ineligible sites include a bridge, a dugout, debris, a mine, Peterson oil camp, and a trash dump. The sites with the unknown or unevaluated eligibility include the Connor Ranch, the Double K Ranch, the T L Ranch, an energy exploration/mine camp, Fort Halleck Road, the Rock Creek to Fort Fetterman Road, a mine, and the R O Buildings. The actual location of the Fort Halleck-Fort Fetterman road is unknown.

Two historic sites, a tin can scatter (48CR5574) and a fence line cairn site (48CR5587), have been located within the Foote Creek Rim Archaeological District. At this time, site eligibility determinations have not been made for these two sites, but will be included in the FEIS.

The intensity of historical and land uses represented in the three alternate transmission line corridors varies. Unnamed historic roads are crossed by all three alternates. The Overland Trail is crossed twice by Alternate 1. The proximity of Alternate 1 to the Overland Trail also suggests the possibility that nonlinear trail-related historic sites (e.g., inscriptions) may be present. The abandoned UP railroad grade is crossed by all three alternates. Other historic land uses, including coal mining and ranching, may also be represented, particularly along Alternate 2.

Eleven historic sites have been recorded within the Alternate 3 ROW. Eight of these sites represent trash and tin can scatters which are of limited quantity and diversity and are ineligible for inclusion on the NRHP. Site 48CR5772 is the UP Railroad spur which serviced Carbon Mine No. 7. The site is considered an ancillary feature of the mine, and thus, is ineligible for the NRHP. Sites 48CR4328 and 48CR5755 are eligible for inclusion on the NRHP. Site 48CR4328 is the abandoned 1868 UP Mainline and is eligible under Criterion A. The portion of the abandoned grade recorded for Alternate 3 is recommended as a contributing segment of the eligible linear site. Site 48CR5755 is the Union Pacific Coal Company Carbon Mine No. 7, which was in operation from 1899 to 1902 and is eligible under Criterion D.

3.3.3 Multicomponent Sites

Twenty-two multicomponent sites have been recorded within the KPPA. The sites consist of a combination prehistoric stone circle/historic hunting area, a stone circle site and historic trail, and open camps/lithic scatters in combination with stockherding camps.

Sixteen multicomponent (prehistoric and historic) sites have been recorded within the Foote Creek Rim Archaeological District. A temporal designation of many of the rock features was problematic due to their similar morphological characteristics and lack of temporally diagnostic artifacts. All prehistoric components of these multicomponent sites have been recommended as eligible for inclusion on the NRHP. Most of the historic rock features appear to be associated with sheep and cattle raising. Fifteen of the 16 historic components of these multicomponent sites have been recommended as eligible for inclusion on the NRHP. Eligibility determinations will be included in the FEIS for this project.

Four multicomponent sites have been recorded within the Alternate 3 ROW. These sites are historic trash and prehistoric lithic/fire-cracked rock scatters that do not possess the integrity, quality, or quantity to be considered eligible for inclusion on the NRHP.

3.4 SOCIOECONOMICS

The geographic area considered for socioeconomic analysis was central Carbon County and central and western Albany County (Map 3.18). Communities in Carbon County included in the analysis were Arlington, Elk Mountain, Hanna, McFadden, Medicine Bow, Rawlins, Saratoga, and Sinclair. Within Albany County, the analysis included the communities of Laramie and Rock River. These communities were selected because they are either in close proximity to the proposed Windplant site, or because they could potentially provide employees and housing.

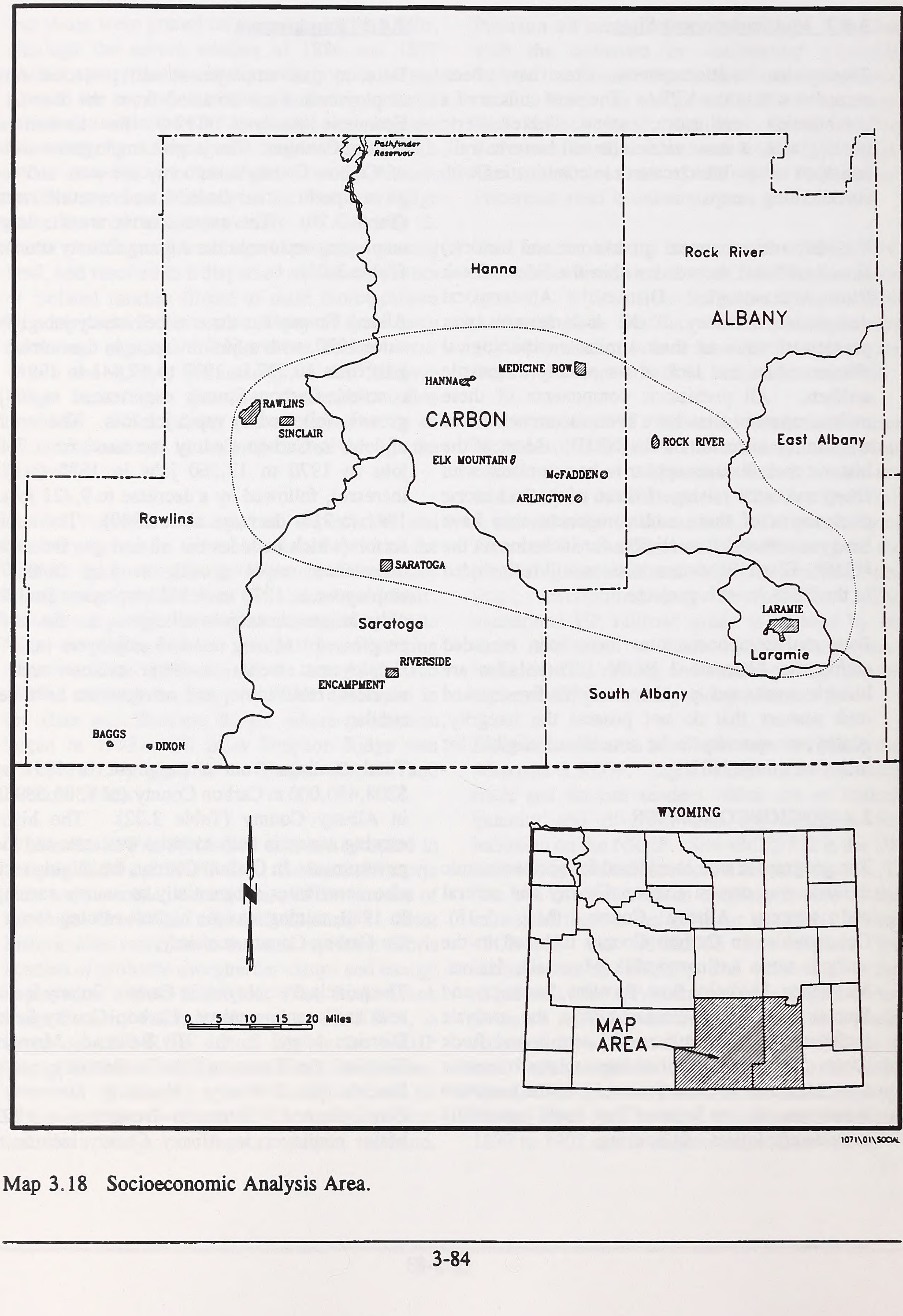
3.4.1 Employment

Data on past employment and projected future employment were obtained from the Bureau of Economic Analysis (1994a) for Carbon and Albany Counties. The largest employment sectors of Carbon County's economy are state and local government, services, and retail trade (Table 3.20). The same sectors are the largest employing sectors in the Albany County economy (Table 3.21).

Albany County has experienced steady job growth since 1970, with a 66% increase in the number of jobs from 10,537 in 1970 to 17,441 in 1991. In contrast, Carbon County experienced rapid job growth, followed by rapid job loss. The number of jobs in Carbon County increased from 7,151 jobs in 1970 to 13,560 jobs in 1980 (a 90% increase), followed by a decrease to 9,423 jobs in 1991 (a 31% decrease since 1980). The mining sector (which includes the oil and gas industries) experienced rapid growth in jobs from 758 employees in 1970 to 3,563 employees in 1980, only to see those jobs disappear as the 1980s progressed. Mining had 843 employees in 1991. Employment trends in other sectors such as services, retail trade, and construction have been similar.

Total earnings from employment in 1991 was $208,430,000 in Carbon County and $300,589,000 in Albany County (Table 3.22). The highest earning sector in both counties was state and local government. In Carbon County, the mining sector also contributes substantially to county earnings. In 1980, mining was the highest earning sector in the Carbon County economy.

The principal employers in Carbon County include coal and uranium mines, Carbon County School Districts 1 and 2, the UP Railroad, Memorial Hospital, the Wyoming State Penitentiary, and the Sinclair Oil Refinery (Wyoming Division of Economic and Community Development 1993). Major employers in Albany County include the



Map 3.18 Socioeconomic Analysis Area.

Table 3.20 Historical Employment, Carbon County, Wyoming, 1970-1991.[1]

Industrial Sector	1970	1975	1980	1985	1990	1991
State and local government	1,128	1,347	1,638	1,940	1,798	1,816
Services	1,164	1,222	2,000	1,987	1,777	1,804
Retail trade	1,247	1,558	1,796	1,567	1,613	1,574
Mining (including oil and gas industries	758	1,501	3,563	1,163	865	843
Transportation and public utilities	885	844	1,015	969	825	811
Manufacturing	429	484	487	452	624	623
Farm and ranch	716	660	637	549	547	527
Construction	219	464	1,208	561	478	473
Finance, insurance, and real estate	210	276	494	359	326	330
Federal government, civilian	160	212	303	268	250	239
Wholesale trade	110	123	227	246	172	178
Agricultural services, forestry, fishing, and other	28	50	80	101	106	108
Federal government, military	97	123	112	120	97	97
Total employment	7,151	8,864	13,560	10,282	9,478	9,423

1 Bureau of Economic Analysis (1994a).

Table 3.21 Historical Employment, Albany County, Wyoming, 1970-1991.[1]

Industrial Sector	1970	1975	1980	1985	1990	1991
State and local government	3,416	4,267	5,032	5,638	6,253	6,423
Services	1,900	1,955	3,121	3,613	3,726	3,824
Retail trade	2,021	2,157	2,848	2,780	3,235	3,234
Finance, insurance, and real estate	484	672	1,006	801	818	833
Manufacturing	583	525	600	708	757	670
Construction	397	585	771	668	580	662
Transportation and public utilities	577	551	681	678	594	591
Farm and ranch	383	386	418	396	386	379
Federal government, civilian	386	442	485	256	264	255
Federal government, military	201	206	164	203	192	198
Wholesale trade	146	173	235	209	199	192
Agricultural services, forestry, fishing, and other	26	37	55	123	153	163
Mining (including oil and gas industries)	17	37	25	25	25	17
Total employment	10,537	11,993	15,441	16,098	17,182	17,441

[1] Bureau of Economic Analysis (1994a).

Table 3.22 Earnings by Industry, Carbon and Albany Counties, 1991.[1]

	Earnings in Thousands of Dollars	
Industrial Sector	Carbon County	Albany County
Farm and ranch	$6,311	$4,019
Agricultural services, forestry, fishing, and other	$1,053	$1,608
Mining (including oil and gas industries)	$38,071	$924
Construction	$9,393	$12,950
Manufacturing	$23,054	$13,581
Transportation and public utilities	$36,138	$18,916
Wholesale trade	$4,372	$3,908
Retail trade	$18,175	$33,015
Finance, insurance, and real estate	$2,600	$7,079
Services	$21,716	$60,138
Federal government, civilian	$7,544	$8,411
Federal government, military	$627	$1,739
State and local government	$39,376	$134,301
Total earnings	$208,430	$300,589

[1] Bureau of Economic Analysis (1994a).

University of Wyoming, Albany County School District, and Ivinson Memorial Hospital.

Unemployment rates in Carbon and Albany Counties have been lower than the national unemployment rate during much of the 1980s and 1990s (Figure 3.5). Peak unemployment in Wyoming and in Carbon County occurred around 1985 at 7.1% and 8.5%, respectively. Carbon County experienced low unemployment during the 1970s and early 1980s, but this abruptly changed during the 1980s. Albany County's peak unemployment occurred around 1970 at 5.8% (Wyoming Division of Economic Analysis 1993a).

The Bureau of Economic Analysis (1994b) has developed employment projections for Wyoming through the year 2040 (Tables 3.23-3.25). Statewide employment is projected to increase to 257,500 in 1995 and decrease to 237,500 in 2040. Carbon County's employment is projected to increase to 9,100 in 2000 and 2005 and decrease to 7,800 in 2040. Albany County's employment is projected to increase to 16,700 in 2005 and decrease to 14,800 in 2040.

3.4.2 Population

Population has followed similar trends as employment (Figure 3.6). Carbon County's population increased 64% from 1970 to 1980 and then decreased 24% by 1990. Albany County's population increased 17% from 1970 to 1990. The state's population increased 41% from 1970 to 1980, then decreased 3% in 1990 (Bureau of the Census 1973, 1982a, 1992a).

Rawlins, with a population of 9,380, and Laramie, with a population of 26,687, are the principal communities in the project's geographic area (Table 3.26). Fifty-six percent of Carbon County's residents live in Rawlins, and 87% of Albany County's residents live in Laramie. The town of Hanna has just over 1,000 residents, and Saratoga has almost 2,000 residents. The smaller communities with between 100 and 500 residents include Rock River, Arlington, Elk Mountain, McFadden, Medicine Bow, and Sinclair (Table 3.26) (Bureau of the Census 1992a; Wyoming Division of Economic and Community Development 1993).

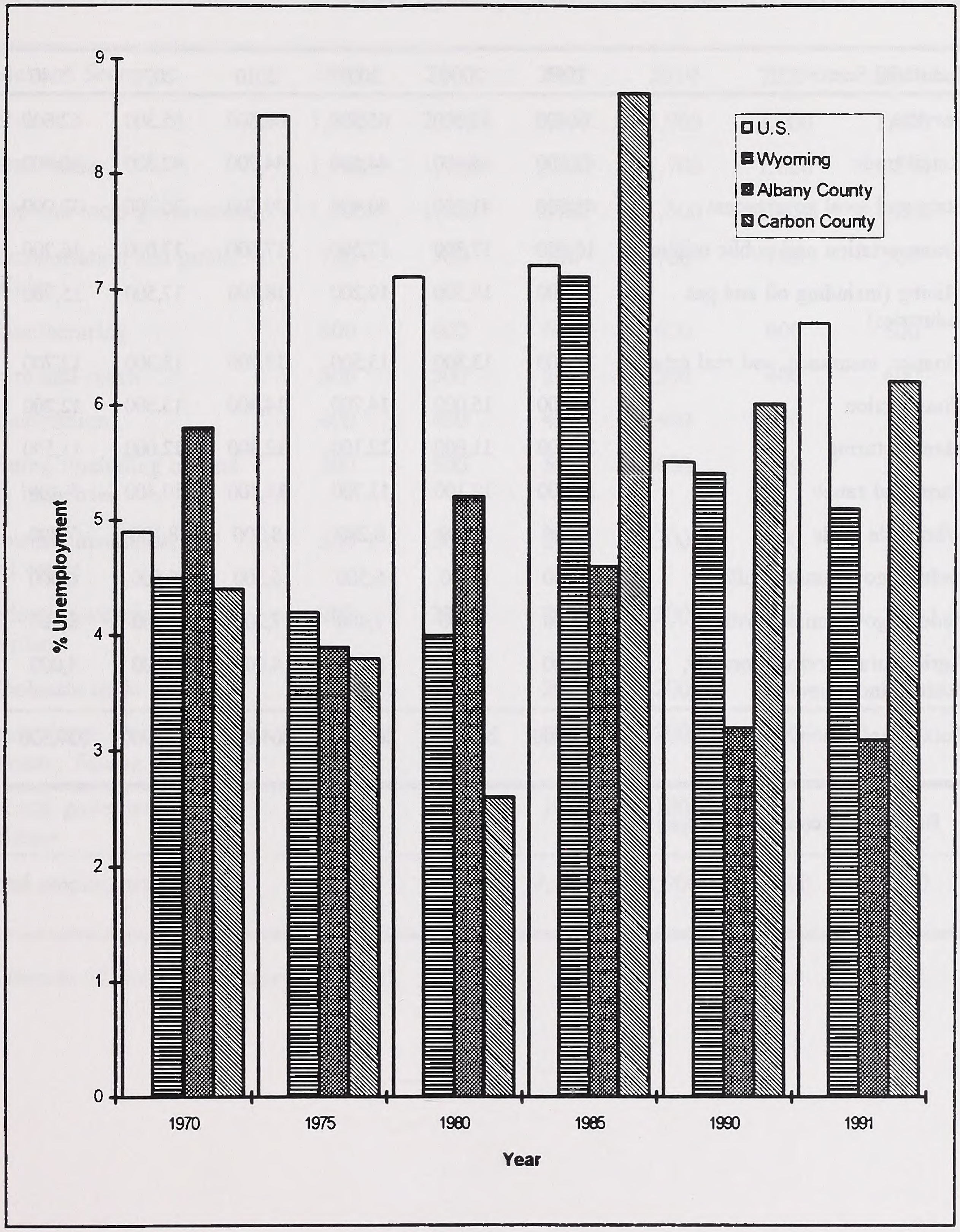
Approximately 29.8% of Carbon County's population and 21.4% of Albany County's population are under 18 years old (Bureau of the Census 1991). In Carbon County, 10.3% of the population is over 64 years old, as is 7.7% of the population in Albany County. The population in both counties is predominantly white, with sizeable Hispanic minority populations (Bureau of the Census 1991). Bureau of Economic Analysis (1994a) population projections foresee an overall decrease in population in both counties, and in Wyoming (Figure 3.7).

3.4.3 Housing

Housing is unevenly distributed in the counties, with most housing occurring in Rawlins and Laramie. The median value for owner-occupied housing in 1990 was $52,300 in Carbon County and $67,100 in Albany County. Rock River had the lowest median value ($29,800), and the South Albany area had the highest median value ($73,500). The median monthly rent was $222 in Carbon County and $296 in Albany County. The lowest median rent was found in the Rock River area ($138), and the highest median rent was in the East Albany area ($300) (Bureau of the Census 1992b).

Vacancy rates are lower for owner-occupied than renter-occupied housing (except in the East Albany area). Carbon County has an owner-occupied housing vacancy rate of 5.7% and a renter-occupied housing vacancy rate of 21.4%. Albany County has an owner-occupied housing vacancy rate of 2.2% and renter-occupied housing vacancy rate of 7.2%. The lowest vacancy rates in the area are for owner-occupied housing in Laramie, and the highest vacancy rates are for renter-occupied housing in Saratoga (22.7%) (Bureau of the Census 1992b).

Laramie has more rental housing units listed in local newspapers than Rawlins. From March 1993



Source: Wyoming Division of Economic Analysis (1993a).

Figure 3.5 Unemployment Rates, 1970-1990.

Table 3.23 Projected Employment, State of Wyoming, 1995-2040.[1]

Industrial Sector	1995	2000	2005	2010	2020	2040
Services	59,400	63,100	65,500	66,500	65,300	62,800
Retail trade	43,100	44,400	44,800	44,700	42,800	40,000
State and local government	41,800	41,200	40,400	39,500	36,700	32,900
Transportation and public utilities	16,800	17,300	17,500	17,600	17,000	16,200
Mining (including oil and gas industries)	19,600	19,500	19,200	18,700	17,500	15,700
Finance, insurance, and real estate	12,900	13,300	13,500	13,700	13,300	12,700
Construction	15,100	15,000	14,700	14,400	13,500	12,200
Manufacturing	11,300	11,800	12,100	12,300	12,000	11,500
Farm and ranch	12,300	12,100	11,700	11,400	10,400	9,100
Wholesale trade	7,900	8,100	8,200	8,300	8,100	7,800
Federal government, military	6,500	6,500	6,500	6,500	6,500	6,500
Federal government, civilian	7,500	7,500	7,400	7,200	6,800	6,100
Agricultural services, forestry, fishing, and other	3,300	3,600	3,900	4,000	4,000	4,000
Total employment	257,500	263,400	265,400	264,800	253,900	237,500

[1] Bureau of Economic Analysis (1994b).

Table 3.24 Projected Employment, Carbon County, Wyoming, 1995-2040.[1]

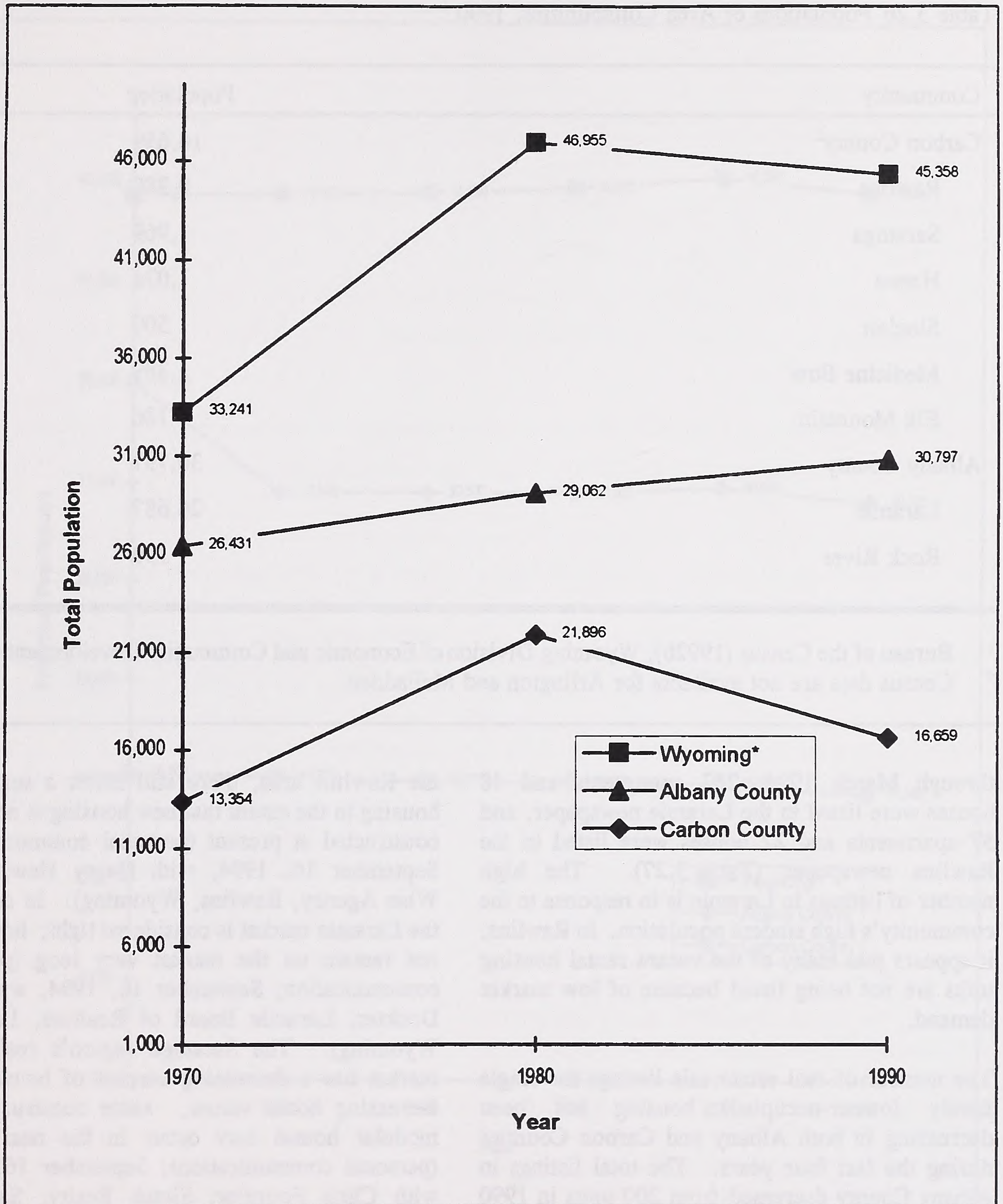
Industrial Sector	1995	2000	2005	2010	2020	2040
Services	1,900	2,000	2,000	2,000	2,000	1,800
Retail trade	1,700	1,700	1,700	1,700	1,600	1,500
State and local government	1,700	1,700	1,700	1,600	1,400	1,200
Transportation and public utilities	700	700	700	700	700	700
Manufacturing	600	600	600	600	600	600
Farm and ranch	500	500	500	500	400	400
Construction	400	400	400	400	400	300
Mining (including oil and gas industries	500	500	500	400	400	300
Finance, insurance, and real estate	300	300	300	300	300	300
Federal government, civilian	200	200	200	200	200	200
Wholesale trade	200	200	200	200	200	200
Agricultural services, forestry, fishing, and other	200	200	200	200	200	200
Federal government, military	100	100	100	100	100	100
Total employment	9,000	9,100	9,100	8,900	8,500	7,800

1 Bureau of Economic Analysis (1994b).

Table 3.25 Projected Employment, Albany County, Wyoming, 1995-2040.[1]

Industrial Sector	1995	2000	2005	2010	2020	2040
Services	4,200	4,500	4,700	4,700	4,700	4,500
State and local government	5,400	5,300	5,200	4,900	4,700	4,200
Retail trade	2,700	2,800	2,800	2,800	2,700	2,500
Finance, insurance, and real estate	700	700	700	800	700	700
Manufacturing	700	800	800	800	800	700
Construction	700	700	700	700	600	600
Transportation and public utilities	600	600	600	600	600	500
Farm and ranch	400	400	400	400	300	300
Federal government, civilian	300	300	300	300	200	200
Federal government, military	200	200	200	200	200	200
Agricultural services, forestry, fishing, and other	100	100	100	200	200	200
Wholesale trade	200	200	200	200	200	200
Mining (including oil and gas industries)	< 100	< 100	< 100	< 100	< 100	< 100
Total employment	16,200	16,600	16,700	16,600	15,900	14,800

[1] Bureau of Economic Analysis (1994b).



*Actual Values are 10x the Values Shown.
Source: Bureau of the Census (1973, 1982a, 1992a).

Figure 3.6 Population Trends, 1970-1990.

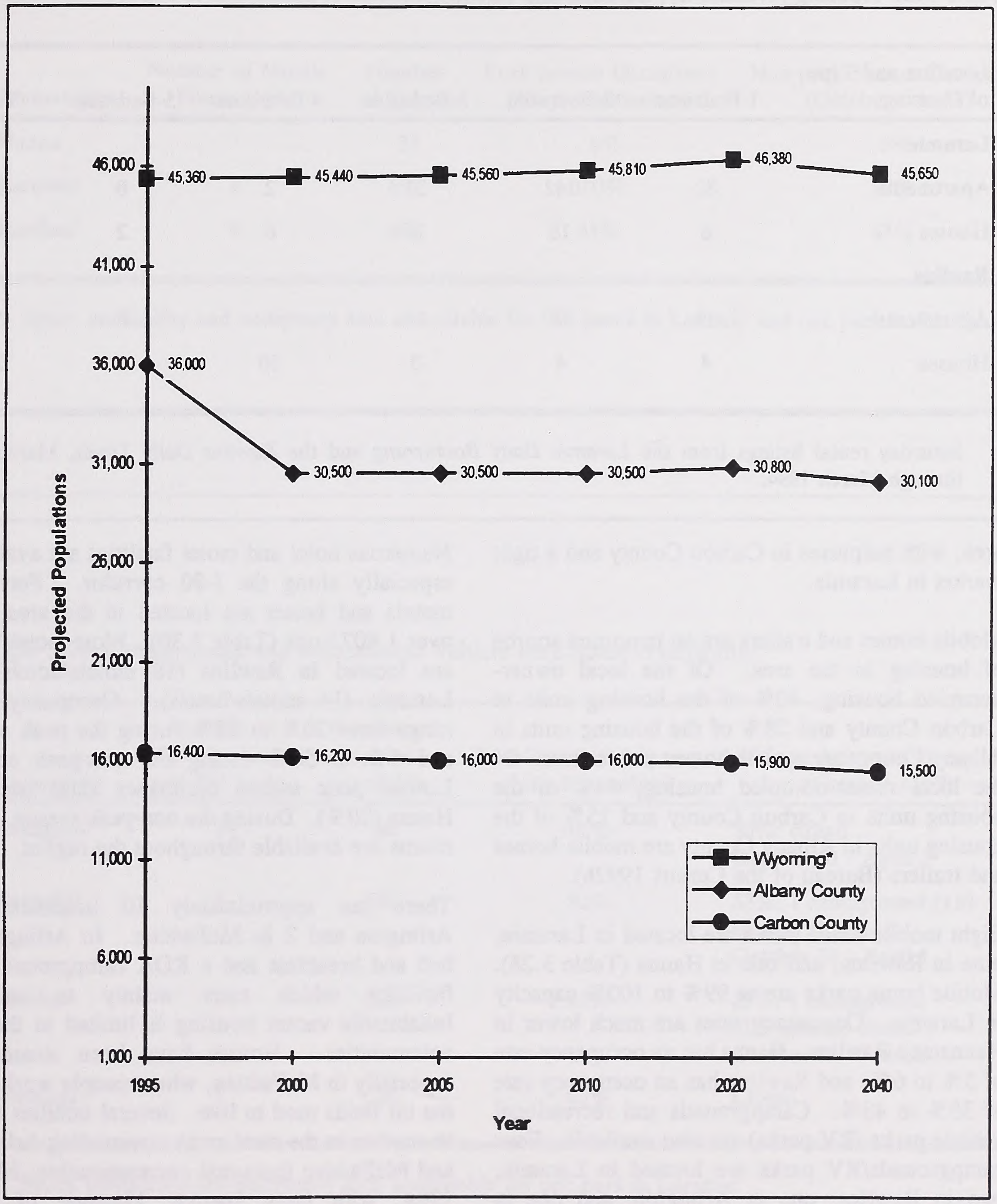
Table 3.26 Populations of Area Communities, 1990.[1]

Community	Population
Carbon County[2]	16,659
Rawlins	9,380
Saratoga	1,969
Hanna	1,076
Sinclair	500
Medicine Bow	389
Elk Mountain	186
Albany County	30,797
Laramie	26,687
Rock River	190

1 Bureau of the Census (1992b); Wyoming Division of Economic and Community Development (1993).
2 Census data are not available for Arlington and McFadden.

through March 1994, 257 apartments and 48 houses were listed in the Laramie newspaper, and 57 apartments and 22 houses were listed in the Rawlins newspaper (Table 3.27). The high number of listings in Laramie is in response to the community's high student population. In Rawlins, it appears that many of the vacant rental housing units are not being listed because of low market demand.

The number of real estate sale listings for single family (owner-occupied) housing has been decreasing in both Albany and Carbon Counties during the last four years. The total listings in Albany County decreased from 200 units in 1990 to 136 units in 1993; as of September 1994, 112 housing units had been listed during 1994 (Laramie Board of Realtors 1994). The listings in Carbon County area decreased from 147 as of January 17, 1990 to 81 listings as of January 20, 1994 (Multiple Listing Service, Rawlins 1994). Although fewer housing units are being listed in the Rawlins area, there still exists a surplus of housing to the extent that new housing is not being constructed at present (personal communication, September 16, 1994, with Henry Hewitt, The Wise Agency, Rawlins, Wyoming). In contrast, the Laramie market is considered tight; houses do not remain on the market very long (personal communication, September 16, 1994, with Lori Dockter, Laramie Board of Realtors, Laramie, Wyoming). The Saratoga region's real estate market has a decreasing surplus of houses with increasing home values; some construction of modular homes may occur in the near future (personal communications, September 16, 1994, with Chris Fournier, Sintek Realty, Saratoga, Wyoming). Hanna's real estate market resembles the Rawlins market, with a large surplus of available housing; many houses were constructed between 1975 and 1980 (personal communication, September 16, 1994, with Dale Yates, retired realtor, Hanna, Wyoming). In summary, homeowner housing is available in most of the



*Actual Values are 10x the Value Shown.
Source: Bureau of Economic Analysis (1994a).

Figure 3.7 Population Projections, 1995-2040.

Table 3.27 Housing Availability, Laramie and Rawlins.[1]

Location and Type of Housing	1-Bedroom	2-Bedroom	3-Bedroom	4-Bedroom	5-Bedroom	Total
Laramie						
Apartments	82	142	31	2	0	257
Houses	6	18	16	6	2	48
Rawlins						
Apartments	19	22	15	1	0	57
Houses	4	4	3	10	1	22

[1] Saturday rental listings from the *Laramie Daily Boomerang* and the *Rawlins Daily Times*, March 1993 through March 1994.

area, with surpluses in Carbon County and a tight market in Laramie.

Mobile homes and trailers are an important source of housing in the area. Of the local owner-occupied housing, 40% of the housing units in Carbon County and 28% of the housing units in Albany County are mobile homes and trailers. Of the local renter-occupied housing, 44% of the housing units in Carbon County and 15% of the housing units in Albany County are mobile homes and trailers (Bureau of the Census 1992b).

Eight mobile home parks are located in Laramie, nine in Rawlins, and one in Hanna (Table 3.28). Mobile home parks are at 99% to 100% capacity in Laramie. Occupancy rates are much lower in Hanna and Rawlins. Hanna has an occupancy rate of 5% to 6%, and Rawlins has an occupancy rate of 35% to 43%. Campgrounds and recreational vehicle parks (RV parks) are also available. Four campgrounds/RV parks are located in Laramie, two in Rawlins, one in Arlington, and one in Saratoga (Table 3.29). Campgrounds and RV parks cater to travelers and tourists. They have high occupancy rates during the peak season (May-September), and low occupancy rates during the remainder of the year. At least four of the parks close during the non-peak season.

Numerous hotel and motel facilities are available, especially along the I-80 corridor. Forty-one motels and hotels are located in the area, with over 1,807 units (Table 3.30). Most motel/hotels are located in Rawlins (18 motels/hotels) and Laramie (14 motels/hotels). Occupancy rates range from 20% to 98% during the peak season and 5% to 56% during the non-peak season. Lowest peak season occupancy rates occur in Hanna (20%). During the non-peak season, many rooms are available throughout the region.

There are approximately 10 households in Arlington and 2 in McFadden. In Arlington, a bed and breakfast and a KOA campground have facilities which cater mainly to tourists. Inhabitable vacant housing is limited in the two communities. Houses have been abandoned, especially in McFadden, where people working in the oil fields used to live. Several families reside in ranches in the rural areas surrounding Arlington and McFadden (personal communication, May 3, 1994, with Gary Gaulke, Manager of KOA campground, Arlington, Wyoming; May 2, 1994, with Goldie Pitcher, caretaker for several historic structures in Arlington and Medicine Bow, Wyoming; May 2, 1994, with Steve Schaeffer, outfitter and manager of a bed and breakfast, Arlington, Wyoming).

Table 3.28 Mobile Home Space Availability.

Community	Number of Mobile Home Parks	Number of Spaces	Peak Season Occupancy (May - September)	Non-peak Season Occupancy (October - April)
Hanna	1	31	6%	5%
Laramie[1]	8	671	100%	99%
Rawlins[1]	8	482	35%	43%

[1] Space availability and occupancy data unavailable for two parks in Laramie and one park in Rawlins.

Table 3.29 Campgrounds and Recreational Vehicle Park Space Availability.

Community	Number of Campgrounds and RV Parks	Number of Spaces Available	Peak Season Occupancy (May-September)	Non-peak Season Occupancy (October-April)
Arlington	1	60	100%	30%; closed October 31 - April 1
Laramie[1]	4	159	92%	53%; 1 campground (110 spaces) closed October 31 - April 1
Rawlins	2	330	65%	25%; 1 campground (180 spaces) closed October 31 - March 1
Saratoga	1	28	65%	Closed

[1] Space availability and occupancy data unavailable for one park in Laramie.

Table 3.30 Motel and Hotel Unit Availability.

Community	Number of Motels/Hotels	Number of Units Available	Peak Season Occupancy (May - September)	Non-peak Season Occupancy (October - April)
Hanna	1	20	20%	20%
Laramie	14	858	93%	56%
Medicine Bow	2	41	80%	30%
Rawlins[1]	18	808	89%	36%
Rock River	1	7	50%	5%
Saratoga[1]	5	73	98%	29%

[1] Unit availability and occupancy data unavailable from two motels/hotels in Rawlins and one in Saratoga.

3.4.4 Schools

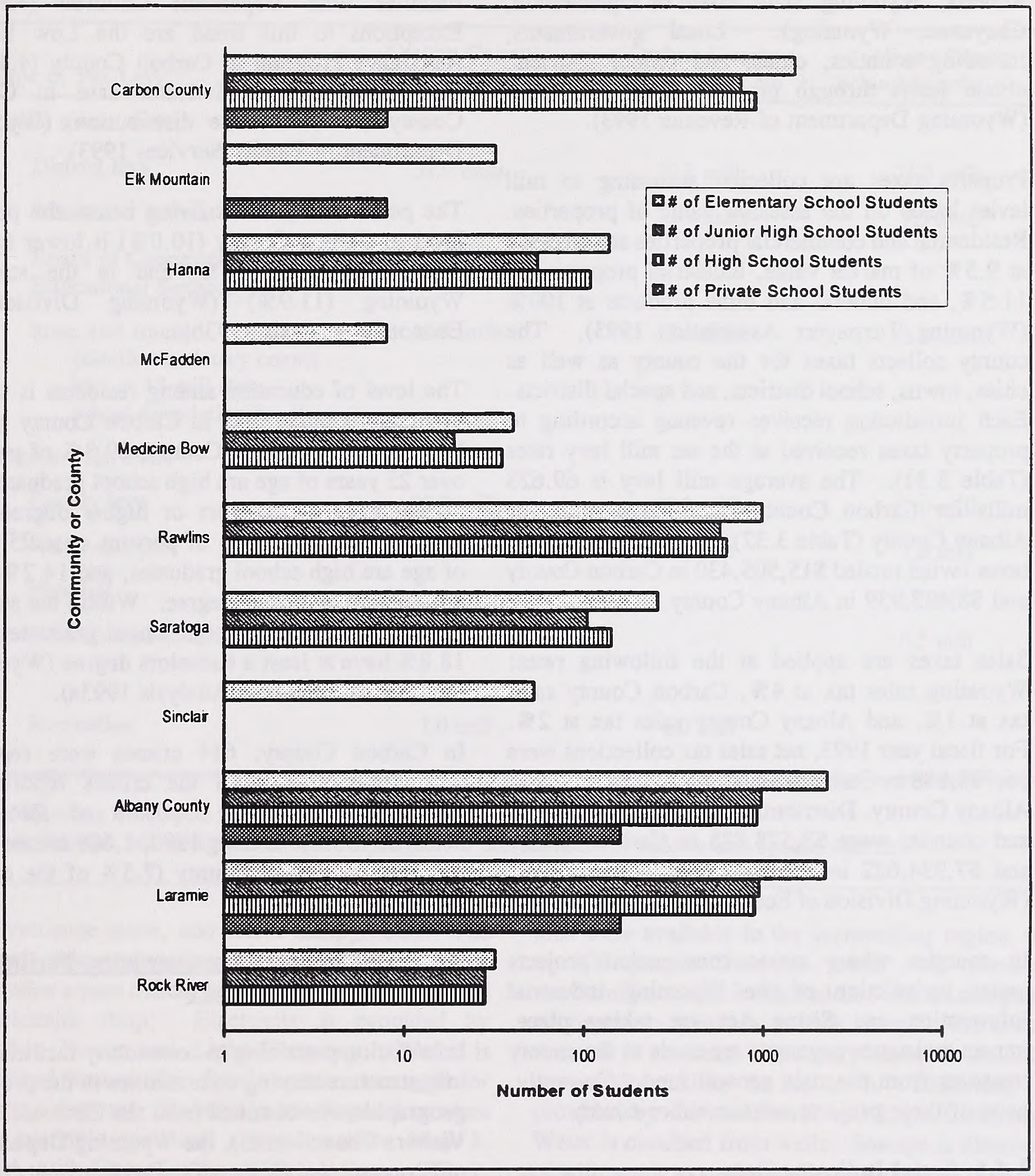
Carbon County has two school districts, and Albany County has one. School enrollment is higher in Albany County than in Carbon County (Figure 3.8) (Wyoming Division of Economic and Community Development 1993; personal communication, April 29, 1994, with Jim House, McFadden Elementary School, McFadden, Wyoming).

Carbon County School District No. 2 is the closest school district to the project area, serving eastern Carbon County. Decreases in school enrollments and new schools constructed in recent years have resulted in a surplus of schools in the district. New schools include a K-12 grade school in Encampment (opened 1993), an elementary school in Medicine Bow (opened 1991), an addition to the elementary school in Saratoga (opened 1993), a junior high school in Saratoga (opened 1993), a high school in Saratoga (opened 1991), and a high school in Hanna (opened 1991) (personal communication, September 16, 1994, with Janice Fiedor, Carbon County School District No. 2, Saratoga, Wyoming). The district has vacant buildings in Hanna and Medicine Bow. Carbon County School District No. 1, serving western Carbon County, is not experiencing crowding. The district has not constructed any new schools during the past three years (personal communication, September 16, 1994, with Gina Gelsleichter, Carbon County School District No. 1, Rawlins, Wyoming). Albany County School District No. 1, serving all of Albany County, has extra capacity for elementary school students, but the district's capacity for additional junior high and high schools students is limited. Two new elementary schools have opened in the district during the past three years (personal communication, September 16, 1994, with Mike Bowman, Albany County School District No. 1, Laramie, Wyoming).

Several colleges and technical schools are located in the area. The University of Wyoming, Wyoming Technical Institute, and the Classic School of Hair Design are located in Laramie. The Carbon County Higher Education Center is located in Rawlins (Wyoming Division of Economic and Community Development 1993).

3.4.5 Local Government Taxation and Revenue

A variety of taxes are collected by the various levels of government in Wyoming. The state obtains revenue principally through mineral severance and sales taxes (personal



Source: Wyoming Divison of Economic Development 1993; personal communication, April 29, 1994, with Jim House, McFadden Elementary School, McFadden.

Figure 3.8 School Enrollment in Communities within Geographic Area, 1992.

communication, April 21, 1994, with Tom Roberts, Wyoming State Board of Equalization, Cheyenne, Wyoming). Local governments, including counties, cities, and school districts, obtain funds through property and sales taxes (Wyoming Department of Revenue 1993).

Property taxes are collected according to mill levies based on the assessed value of properties. Residential and commercial properties are assessed at 9.5% of market value, industrial properties at 11.5%, and mineral and mine products at 100% (Wyoming Taxpayers Association 1993). The county collects taxes for the county as well as cities, towns, school districts, and special districts. Each jurisdiction receives revenue according to property taxes received at the set mill levy rates (Table 3.31). The average mill levy is 69.623 mills for Carbon County and 76.374 mills for Albany County (Table 3.32). In fiscal year 1993, taxes levied totaled $15,505,430 in Carbon County and $8,135,939 in Albany County.

Sales taxes are applied at the following rates: Wyoming sales tax at 4%, Carbon County sales tax at 1%, and Albany County sales tax at 2%. For fiscal year 1993, net sales tax collections were $6,708,888 in Carbon County and $12,518,897 in Albany County. Distributions of sales tax to cities and counties were $3,578,888 in Carbon County and $7,934,622 in Albany County (Table 3.32) (Wyoming Division of Economic Analysis 1993b).

In counties where major construction projects under jurisdiction of the Wyoming Industrial Information and Siting Act are taking place, impact assistance payments are made to the county treasurer from the state general fund. Currently, none of these projects exist in either county.

3.4.6 Social Indicator Data

Residents of Carbon and Albany Counties tend to receive less than their expected share of assistance based on population. For example, Carbon County has 3.7% of the state's population but has 2.7% of the state's food stamp recipients. Albany County has 6.7% of the state's population but has only 5.4% of the state's recipients of Aid to Families with Dependent Children (AFDC). Exceptions to this trend are the Low Energy Assistance Program in Carbon County (4.1% of state distribution) and foster care in Carbon County (6.5% of state distribution) (Wyoming Department of Family Services 1993).

The percent of persons living below the poverty level in Carbon County (10.0%) is lower than in Albany County (19.8%) and in the state of Wyoming (11.9%) (Wyoming Division of Economic Analysis 1993b).

The level of education among residents is higher in Albany County than in Carbon County and in Wyoming. In Albany County, 89.3% of persons over 25 years of age are high school graduates and 38.5% have a bachelors or higher degree. In Carbon County, 81.7% of persons over 25 years of age are high school graduates, and 14.2% have a bachelors or higher degree. Within the state of Wyoming, 83.0% are high school graduates, and 18.8% have at least a bachelors degree (Wyoming Division of Economic Analysis 1993a).

In Carbon County, 614 crimes were reported during 1992 (2.9% of the crimes reported in Wyoming) (Wyoming Division of Economic Analysis 1993a). During 1992, 1,608 crimes were reported in Albany County (7.5% of the crimes reported in Wyoming).

3.4.7 Community Characteristics, Facilities, and Infrastructure

Information pertaining to community facilities and infrastructure serving communities in the project's geographic was obtained from the Carbon County Visitors Council (n.d.), the Wyoming Department of Economic and Community Development (1993), and personal communications.

The community of Arlington is closest to the proposed Windplant site. Arlington has approximately 10 households; a Highway Department road maintenance facility; a bed and breakfast; and a combination service station,

Table 3.31 Property Tax Rates, Carbon and Albany Counties, 1993.[1]

Type of Tax Levy	Carbon County School District No. 1	Carbon County School District No. 2	Albany County School District No. 1
Public school levies			
District levy	31.0 mills	27.0 mills	28.0 mills
Bonds and interest	--	13.9 mills	7.5 mills
Board of Cooperative Educational Services	1.0 mill	--	--
State and county (6-mill mandatory county levy + 12-mill state school foundation fund)	18.0 mills	18.0 mills	18.0 mills
District-wide levies[2]			
County levy	12.0 mills	12.0 mills	12.0 mills
Weed and pest	1.0 mill	1.0 mill	1.0 mill
Hospital	--	--	3.0 mills
Conservation District	--	--	0.5 mill
Recreation	1.0 mill	1.0 mill	--

[1] Wyoming Taxpayers Association (1993).
[2] Additional mill levies are levied on portions of the districts for schools and special districts.

convenience store, and KOA campground. The town's unique attraction is a historic district which includes a post office, homestead, horse barn, and blacksmith shop. Electricity is provided by Carbon Power and Light Company. Water is obtained from wells. Septic systems are used for sewage disposal. No solid waste disposal services are available (personal communication, May 3, 1994, with Gary Gaulke, KOA Manager; May 2, 1994, with Goldie Pitcher, historic structure caretaker; May 2, 1994, with Steve Schaeffer, outfitter and manager of a bed and breakfast, Arlington, Wyoming).

McFadden is the second closest community to the Foote Creek Rim area. In the past, when oil field jobs were available in the surrounding region, up to 400 people lived in town. At present, two families reside in McFadden. An oil company continues to maintain a work camp in the town. A small (8 students) elementary school is the only community facility in the town. Electricity is provided by Carbon Power and Light Company. Water is obtained from wells. Sewage is disposed of with septic systems, and no solid waste disposal services are available (personal communication, May 3, 1994, with Gary Gaulke, Manager of KOA campground, Arlington, Wyoming; April 29, 1994, with Jim House, McFadden Elementary School, McFadden, Wyoming; May 2, 1994, with Goldie Pitcher, caretaker for several historic structures in Arlington, Medicine Bow, Wyoming;

Table 3.32 Taxation Statistics, Carbon and Albany Counties, Fiscal Year 1993.[1]

Category	Carbon County	Albany County
Property tax		
Average mill levy	69.623 mills	76.374 mills
Assessed valuation	$222,706,563	$106,527,496
Total taxes levied	$15,505,498	$8,135,931
Sales tax		
State sales tax rate	4%	4%
County sales tax rate	1%	2%
Net collections	$6,708,888	$12,518,897
Distributions to cities and counties	$3,578,588	$7,934,622
Lodging tax		
County lodging tax rate	2%	2%
Distributions to counties: includes collections less 1% administrative fee	$144,083	$123,623

1 Wyoming Department of Revenue (1993); Wyoming Division of Economic Analysis (1993b); and Wyoming Division of Economic and Community Development (1993).

May 2, 1994, with Steve Schaeffer, outfitter and manager of a bed and breakfast, Arlington, Wyoming).

Laramie is the county seat for Albany County and home of the University of Wyoming. Laramie's police department has 39 full-time personnel, and the fire department has 41 full-time personnel. The city has 5 libraries with 1,166,634 volumes. Laramie has one hospital with 99 beds. Recreational facilities include seven baseball fields, 21 tennis courts, one swimming pool, two golf courses, seven soccer fields, one skating rink, one recreation center, and 11 parks. Unique attractions include the Wyoming Territorial Park and the Laramie Plains Museum. Utility providers include Pacific Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the City of Laramie for water. Sewage treatment service and solid waste disposal service are provided in Laramie.

Rock River is the only other community, besides Laramie, in the Albany County portion of the Windplant's geographic area. The town is located in the west-central part of the county. Rock River's police protection is provided by the Albany County Sheriff, and fire protection is provided by a 10-person volunteer fire department. Rock River's library has 3,300 volumes. Recreational facilities include one tennis court, one skating rink, and one park. Rock River's unique attraction is the Dinosaur and Old West Museum. Utility providers include Carbon Power and Light Company for electricity and the town of Rock River for water. Sewage treatment and solid waste disposal services are available.

Elk Mountain developed as an outpost on the Overland trail and presently serves as a gateway from I-80 to the Medicine Bow National Forest. Elk Mountain's police protection is provided by the Carbon County Sheriff, and fire protection is provided by a volunteer fire department. The city has a park and a library with 2,000 volumes. Elk Mountain's unique attraction is the Elk Mountain Hotel. Electrical service is provided by Carbon Power and Light and water by the town of Elk Mountain. Sewage treatment and solid waste disposal services are available.

Hanna developed as a coal-mining community along the UP Railroad line. Hanna is served by a 2-person police department and an 18-person volunteer fire department. The Hanna library contains 8,000 volumes. Recreational facilities include two baseball fields, two tennis courts, one swimming pool, one soccer field, one skating rink, one recreation center, and one park. Hanna's unique attractions include the Miner's Monument and the UP snow plow in the town park. Utility providers include Pacific Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the town of Hanna for water. Sewage treatment and solid waste disposal service are available.

Medicine Bow developed as a station stop for the UP Railroad in the 1860s and later became stopping point on the Lincoln Highway during the 1930s. Medicine Bow has a 1-person police department, and a 15-person volunteer fire department. Medicine Bow has a 2,000 volume library. Recreational facilities include one baseball field and one tennis court. Unique attractions are the Virginian Hotel and the Medicine Bow Museum. Utility providers are Hot Springs Rural Electric Association for electricity, Northern Gas Company of Wyoming for natural gas, and the town of Medicine Bow for water. Sewage treatment and solid waste disposal service are available.

Rawlins is the county seat and principal commercial and administrative center in Carbon County. Rawlins' police department has 20 full-time personnel, and the fire department has 8 full-time personnel and 20 volunteers. A 93-bed hospital serves Rawlins and the surrounding region. The city's library has 60,000 volumes. Recreational facilities include six baseball fields, eight tennis courts, one swimming pool, one bike path, four soccer fields, one skating rink, one recreation center, and eight parks. Unique attractions include the Frontier Prison and Outlaw Days, and the County Fair and Rodeo in August. Utility providers are Pacific Power and Light for electricity, Northern Gas Company of Wyoming for natural gas, and the city of Rawlins for water. Sewage treatment and solid wastes disposal services are provided.

Saratoga is known for its hot springs. The town is served by a 12-person police department and a fire department with 32 volunteers. Saratoga has a 10,000 volume library. Recreational facilities include five baseball fields, two tennis courts, two swimming pools, two golf courses, two soccer fields, two skating rinks, and five parks. Unique attractions are the hot springs and historic/cultural center. Utility providers are Carbon Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the town of Saratoga for water. Sewage treatment and solid waste disposal services are available.

Sinclair has a 2-person police department and a volunteer fire department with 15 volunteers. The Sinclair library has 7,000 volumes. Recreational facilities include one baseball field, one tennis court, one golf course, one skating rink, one recreation center, and two parks. Unique attractions are Spanish architecture and Parco/Sinclair National Historic Museum. Utility providers are Pacific Power and Light Company for electricity, Northern Gas Company of Wyoming for natural gas, and the town of Sinclair for water. Sewage treatment and solid waste disposal services are available.

Law enforcement in rural areas is provided by the Carbon County and Albany County Sheriff's Departments. Carbon County has 25 officers

(full-time, part-time, and detention facility) and Albany County has 33 officers.

Regional recreation attractions include the Medicine Bow National Forest (in southwestern Albany County and southeastern Carbon County), Snowy Range Ski Area (southwestern Albany County), Wheatland Reservoir (central Albany County), and Seminoe Reservoir and State Park in central Carbon County.

3.4.8 Transportation

Surface transportation in Carbon County is provided by a network of primary, secondary, local, and primitive roads. Approximately 62 mi (100 km) of county roads and improved gravel roads present in the KPPA link with numerous smaller roads on the area, providing access to most locations within the KPPA. Approximately 1,172 mi (1,886 km) of roads currently exist on and adjacent to the KPPA (Map 3.19). Existing roads within the KPPA are used for connecting two communities or larger roads, recreation, grazing management, and mineral exploration and development.

Eight principal roads of varying size and quality either access or border the KPPA (Table 3.33). I-80 is the principal roadway servicing intercontinental traffic across southern Wyoming. Within Carbon County, I-80 links the communities of Arlington, Elk Mountain, Walcott, Sinclair, and Rawlins. I-80 forms the southern border of the Foote Creek Rim and Simpson Ridge areas and provides access to the KPPA via three major interchanges: Wyoming Highway 13 at Arlington, and County Road 3 and Wyoming Highway 72 at Elk Mountain. U.S. Highway 30/287 provides access to the KPPA from the north via three principal interchanges: County Road 1, County Road 115, and Wyoming Highway 72.

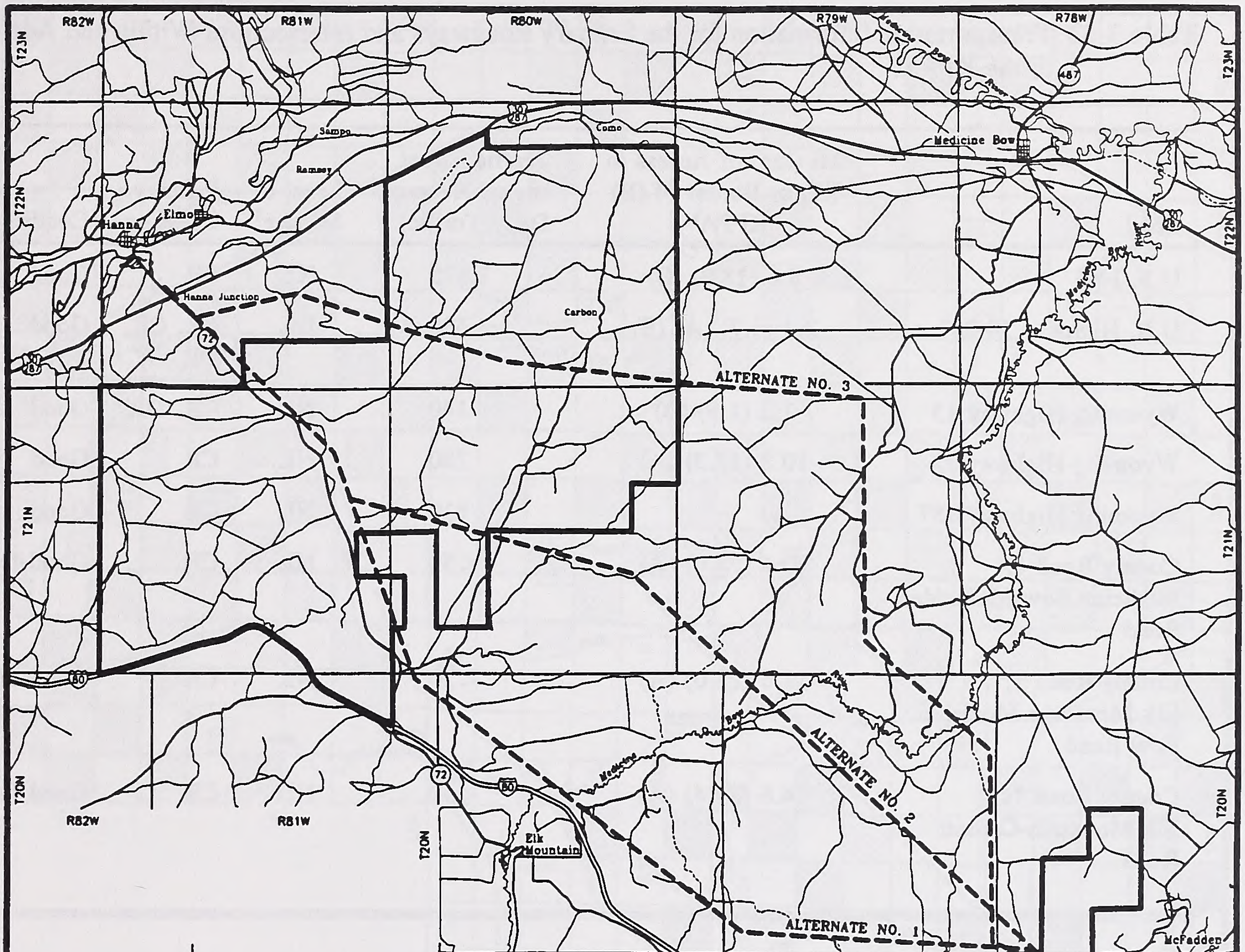
Access to the Foote Creek Rim area is provided by Wyoming Highway 13, a primary road, which runs north from I-80 at Arlington to Rock River and by County Road 1, which runs from McFadden to Medicine Bow. The top of Foote Creek Rim is reached via improved and unimproved unpaved roads. The proposed transmission line routes have between 17 and 31 access points (depending on the ROW) provided by Wyoming Highway 72, County Road 3, and numerous improved and unimproved unpaved roads. Primary access to the Simpson Ridge area is provided by Wyoming Highway 72 and County Road 15.

Average daily traffic counts, levels of service, and primary uses for major roads within and adjacent to the KPPA are presented in Table 3.33. Traffic volumes on all roads associated with the project area are well under projected traffic capacities. For example, daily traffic counts along I-80 average 7,670 vehicles; however, the interstate highway has a capacity of 8,000 vehicles per hour. Traffic volumes along the major two-lane roads in the area average between 140-810 vehicles per day, whereas the capacity of these roads is typically 2,000 vehicles per hour. Because traffic volumes are low compared with roadway capacities, the level of service provided is not limited or only partially limited by traffic (personal communication, July 1994, with John Lane, Wyoming Department of Transportation, Cheyenne) (Table 3.33).

The main line of the UP Railroad goes through Laramie, Medicine Bow, Hanna, and Rawlins, and is a major east-west rail line through the central U.S. Rawlins has a large switchyard for this double-track system. A small community airport with a 7,700 ft long runway is located at Rawlins, but only charter service is available from this airport. Commercial airline service is provided by Mesa-United Express at the Laramie Regional Airport [runway length 7,700 ft (2,347 km)] (personal communication, July 1994, with Sonya Walker, Weather Observer, Laramie Regional Airport).

3.5 LAND USE

Of the 60,619 ac within the KPPA, approximately 16,973 ac (28%) are federally owned, 37,584 ac (62%) are privately owned, and 6,062 ac (10%)



Map 3.19 Roads Within and Adjacent to the KPPA.

Table 3.33 Transportation Information for the Primary Roadways and Intersections Within and Adjacent to the KPPA.

Road	Mi (km) of Access to (A) or Border of (B) KPPA[1]	Traffic Count (Annual Average Daily Traffic)	Level of Service[2]	Primary Uses[3]	Condition
U.S. I-80	8.6 (13.8) (B)	7,670	NL	BR	Good
U.S. Highway 30-287	2.3 (3.7) (A) (B)	630	NL	BR, CR, DR	Good
Wyoming Highway 13	1.2 (1.9) (B)	140	NL	CR, DR	Good
Wyoming Highway 72	10.8 (17.3) (A)	280	NL	CR	Good
Wyoming Highway 487	--	810	NL	CR	Good
County Road 1; Medicine Bow-McFadden Road	20.6 (33.0) (A)	<50	NL	CR	Good-fair
County Road 3; Elk Mountain-Medicine Bow Road	17.5 (28.0) (A)	<50	NL	CR	Good-fair
County Road 115; Elk Mountain-Carbon Road	14.6 (23.4) (A)	<50	NL	CR	Good-fair

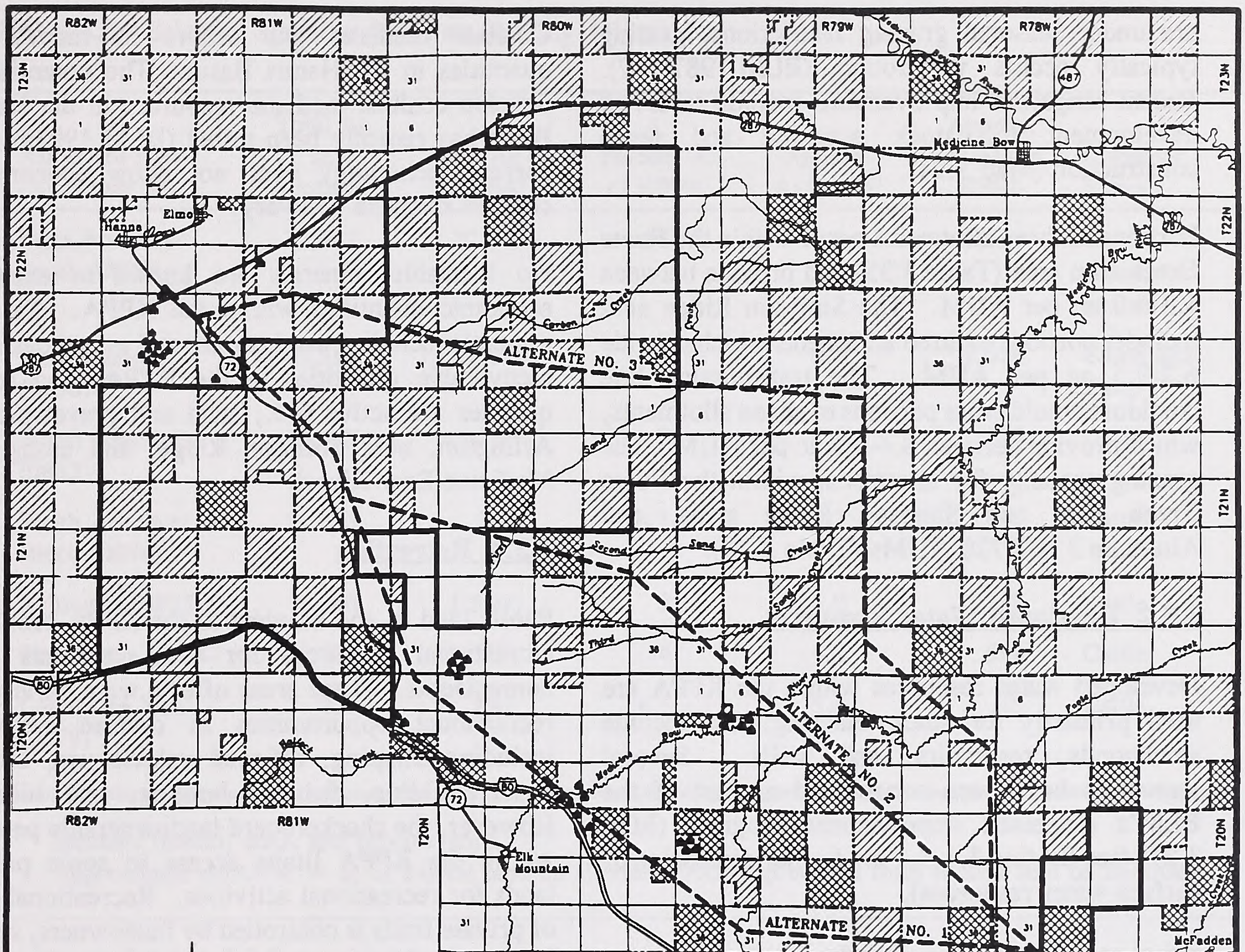
1 A = Access; B = Border.
2 NL = Travel not limited by traffic.
3 BR = Bridge road for intercontinental traffic; CR = Connecting road between two communities or larger roads; DR = Detour route.

are state owned (Map 3.20). Landownership is primarily a checkerboard pattern of alternating federal and private ownership. The BLM administers federal lands, and the State of Wyoming manages the state lands for the State School Trust.

Major land uses within and adjacent to the KPPA are agriculture (primarily cattle and sheep grazing); wildlife habitat; oil and natural gas exploration, development, and transportation; and dispersed outdoor recreation (e.g., hunting, hiking, camping, wildlife observation, nature photography, and off-road vehicle use). No developed recreation resources exist within the project area; however, the Wick Unit, which includes approximately 3,854 ac (77%) of the Foote Creek Rim area and 19-37 ac of the alternate transmission line routes, was set aside by the WGFD for recreational wildlife viewing (Map 3.9). A public fishing access point is located east of Foote Creek Rim on Rock Creek north of I-80 on Highway 13.

3.5.1 Agriculture/Rangeland

Livestock grazing is the major form of agriculture in the project area. All or portions of 7 grazing allotments occur in the KPPA. Grazing lands within the KPPA provide approximately 7,720 animal unit months (AUMs) for cattle, sheep, and horses (Table 3.34). Although some allotments



Map 3.20 Landownership.

are under seasonal grazing restrictions, grazing typically occurs year-round (BLM 1987:117). Recent rangeland improvements include reservoir development for stock watering and fence construction (Map 3.21).

Portions of three allotments occur within the Foote Creek Rim area (Table 3.35) and provide between 4.3-6.0 ac per AUM. The Simpson Ridge area includes portions of three allotments which provide 6.2-9.5 ac per AUM. The transmission line corridors would cross portions of seven allotments, which provide between 4.4-9.5 ac per AUM. The grazing capacity for allotments within the Foote Creek Rim and Simpson Ridge areas, and Alternate 3 is 7,720 AUMs (Table 3.34).

3.5.2 Developed Water Resources

Developed water resources within the KPPA are used primarily for stock watering, and include stockponds, reservoirs, and wells. Several reservoirs have been constructed as part of the BLM's rangeland improvement program (Map 3.21) (see Section 3.1.5.1 for further discussion of surface water resources).

3.5.3 Extractive Mineral Operations/Oil and Gas Production

In 1992, there were 4 oil and gas fields within the KPPA. Seven active wells produced 31,288 bbls of oil and 9,720 mcf of gas during 1992. Eight oil and gas lessees hold leases within the KPPA. Lease locations are illustrated on Map 3.22.

No commercial coal development is presently occurring within the KPPA (see Section 3.1.3.1). Commercial coal development in the project area will depend upon future demand, opening of new markets, and changes in technology to meet new demands.

Because coal in the area is relatively deeply buried (compared to coal in the Powder River Basin), the potential for near-future development of these coal resources is low.

Coalbed methane gas occurs in recoverable quantities in the Hanna Basin. The potential to develop coalbed methane resources in the Hanna Basin has recently been tested (BLM 1993a), but current technology does not allow economical coalbed methane recovery.

No locatable minerals are known to exist in economic quantities within the KPPA. Salable minerals including sand, stone, and gravel occur in recoverable quantities in the KPPA, and some quarries are active (i.e., sand and gravel pits at Arlington, near Simpson Ridge, and along the Medicine Bow River).

3.5.4 Recreation

Public land in and adjacent to the KPPA provides recreational resources for local residents and nonresidents. These areas offer a wide variety of recreational opportunities in diverse settings, including camping, off-road vehicle use, cross-country skiing, fishing, hunting, and hiking. However, the checkerboard landownership pattern within the KPPA limits access to some public lands for recreational activities. Recreational use of private lands is controlled by landowners, some of whom charge an access fee for hunting privileges on the lands on which they control access.

Limited recreational use data are available for the project area. Big game hunting is likely the predominant recreational activity. Table 3.36 shows 1993 big game herd unit harvest statistics for herd units within and adjacent to the KPPA. In 1993, 10,787 pronghorn hunters, 10,332 mule deer hunters, 1,056 white-tailed deer hunters, and 6,855 elk hunters hunted in the units within which the KPPA is located. A total of 93,295 recreation days was spent within these harvest areas, and over 14,889 big game animals were harvested. The average time spent hunting ranged from 2.1 days for pronghorn to 18.2 days for elk. Additional hunting for sage grouse, mourning dove, cottontails, and predators probably occurs independent of, or in conjunction with, big game

Table 3.34 Selected Statistics for Area Grazing Allotments.

Allotment Name (Allotment No.)	Total Ac in Allotment	Total Ac on KPPA[1]	Percent Ac of KPPA[1]	Approx. Ac/AUM[2]	Approx. AUMs in KPPA	Livestock Types
Dana Meadows South (0829)	37,467	22,013	36	6.2	3,550	Cattle, sheep, and horses
Chace Block (0830)	65,512	29,014	48	9.5	3,054	Cattle and sheep
North Anschutz (0832)	40,983	1,755	3	7.9	222	Cattle
South Anschutz Block (0854)	16,903	59	<1	8.7	7	Cattle
Arlington (0855)	2,040	1,550	3	6.0	258	Cattle
Pine Ridge (0856)	5,509	2,512	4	4.3	584	Cattle
Lonesome Fox (0879)	820	250	<1	5.6	45	Cattle

1 Includes federal, state, and private lands.
2 Approximate ac/AUM = ac of federal land on allotment/AUMs produced from federal land on allotment.

hunting. Section 3.2.2 provides further detail on big game herds and fisheries in the KPPA. No developed recreation sites occur within the KPPA.

WGFD holds easements on all or portions of four sections within the Foote Creek Rim area (Map 3.22), which have been set aside for public recreational use. No data are available on actual use in these areas, but because they are on top of Foote Creek Rim and are difficult to access, recreational use is probably limited.

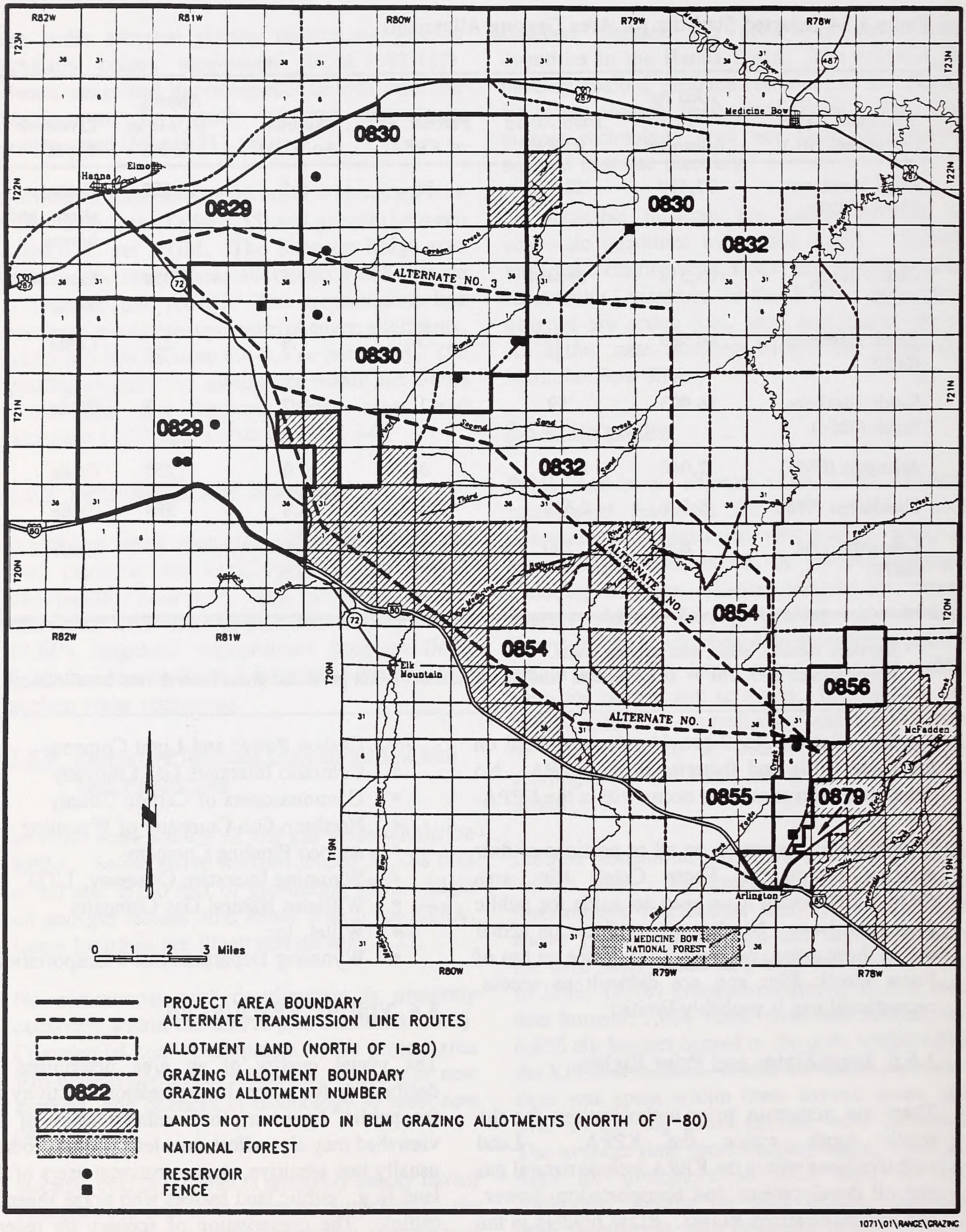
3.5.5 Land Status and Prior Rights

There are numerous prior authorizations for the public lands within the KPPA. Land authorizations within the KPPA include natural gas and oil developments and transportation, power, and communications ROWs. ROW holders in the area include:

- Carbon Power and Light Company
- Colorado Interstate Gas Company
- Commissioners of Carbon County
- Northern Gas Company of Wyoming
- Amoco Pipeline Company
- Wyoming Interstate Company, LTD
- Williams Natural Gas Company
- Wiltel, Inc.
- Wyoming Department of Transportation

3.6 VISUAL RESOURCES

The visual quality of an area determines its desirability for a specific recreational activity by the public; however, the aesthetic value of the viewshed may also affect, to a lesser extent, other, usually less sensitive, nonrecreational users of the land (e.g., public land lessees who graze sheep or cattle). The preservation of scenery by federal agencies, in balance with responsible development,



Map 3.21 Grazing Allotments and Range Improvements.

Table 3.35 Approximate Acreage of the KPPA on Each Grazing Allotment.

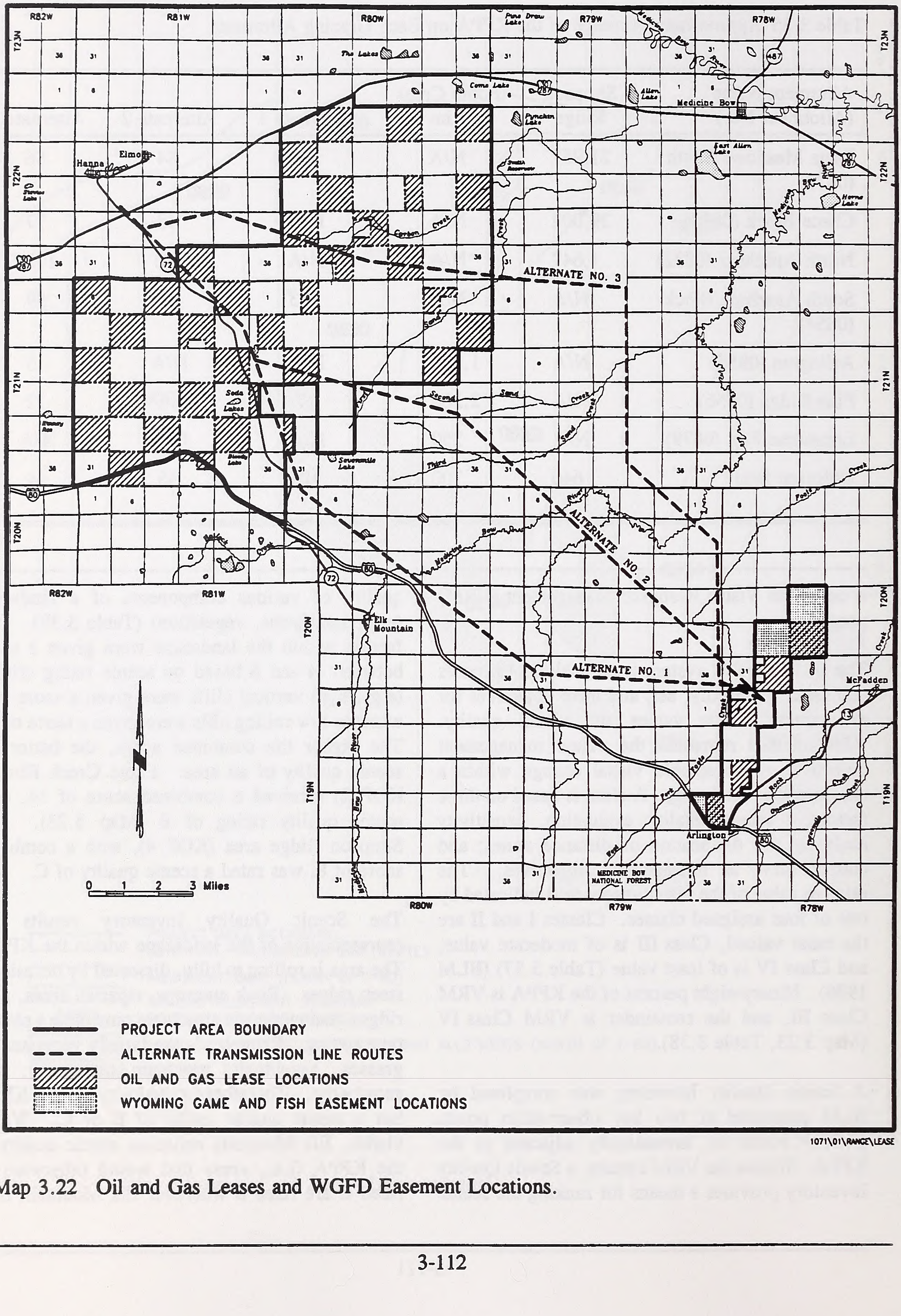
Allotment Name (Allotment No.)	Simpson Ridge	Foote Creek Rim	Alternate 1	Alternate 2	Alternate 3
Dana Meadows South (0829)	21,957	N/A	96	84	56
Chace Block (0830)	29,002	N/A	N/A	40	77
North Anschutz (0832)	1,647	N/A	N/A	71	108
South Anschutz Block (0854)	N/A	N/A	93	49	59
Arlington (0855)	N/A	1,550	N/A	N/A	5
Pine Ridge (0856)	N/A	2,500	17	16	12
Lonesome Fox (0879)	N/A	250	N/A	N/A	N/A
Unleased land	640	700	104	36	44

is central to Visual Resource Management (VRM) programs.

The BLM's VRM system is an analytical process that seeks to identify, set, and meet objectives for maintaining scenic values and visual quality. VRM classes represent the visual management objectives of acceptable visual change within a characteristic landscape. A class is based on three factors: scenic quality evaluation, sensitivity analysis, and delineation of distance zones; and classes serve as management objectives. The relative value of the visual resource is indicated by one of four assigned classes. Classes I and II are the most valued, Class III is of moderate value, and Class IV is of least value (Table 3.37) (BLM 1986). Ninety-eight percent of the KPPA is VRM Class III, and the remainder is VRM Class IV (Map 3.23, Table 3.38).

A Scenic Quality Inventory was completed by BLM personnel at two key observation points (KOPs) within or immediately adjacent to the KPPA. Within the VRM system, a Scenic Quality Inventory provides a means for ranking the scenic quality of various components of a landscape (e.g., landforms, vegetation) (Table 3.39). Key factors within the landscape were given a score between -4 and 6 based on scenic rating criteria (e.g., high vertical cliffs were given a score of 6 whereas low rolling hills were given a score of 1). The higher the combined score, the better the scenic quality of an area. Foote Creek Rim (at KOP 2) received a combined score of 14, or a scenic quality rating of B (Map 3.23). The Simpson Ridge area (KOP 4), with a combined score of 8, was rated a scenic quality of C.

The Scenic Quality Inventory results are representative of the landscape within the KPPA. The area is rolling to hilly, dissected by occasional steep ridges. Rock outcrops, riparian areas, pine ridges, and manmade structures punctuate a plains-type setting. Rangelands are largely vegetated by grasses, sagebrush, mountain mahogany, and snowberry. Therefore, a majority of the KPPA has a scenic quality rating of B or C. Where visible, Elk Mountain enhances scenic quality in the KPPA (i.e., areas that would otherwise be rated C are rated B wherever Elk Mountain is in



Map 3.22 Oil and Gas Leases and WGFD Easement Locations.

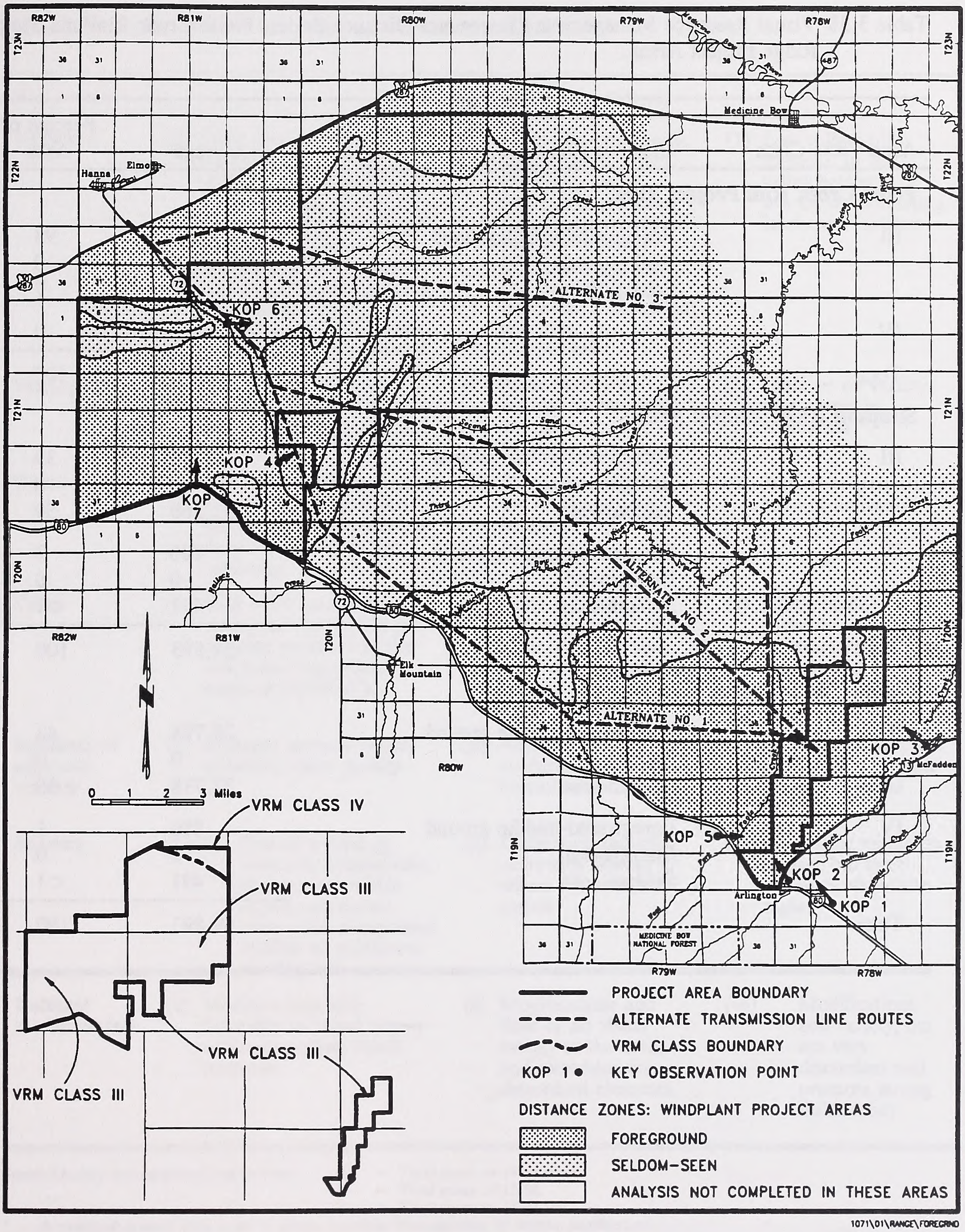
Table 3.36 Selected 1993 Big Game Herd Unit Harvest Statistics.

Species/Herd Unit	Harvest	No. of Hunters	Recreation Days[2]	Days/Animal Harvested
Pronghorn				
Centennial Herd	1,568	1,911	3,218	2.1
Cooper Lake Herd	357	451	870	2.4
Elk Mountain Herd	1,100	1,278	2,476	2.3
Medicine Bow Herd	5,943	7,147	12,221	2.1
Mule Deer				
Platte Valley Herd	1,715	5,412	19,041	11.1
Sheep Mountain Herd	1,023	3,020	11,233	11.0
Shirley Mountain Herd	1,009	1,900	4,868	4.8
White-tailed Deer				
Laramie River Herd	203	1,056	3,571	17.6
Elk				
Snowy Range Herd	1,971	6,855	35,797	18.2

[1] Information taken from WGFD (1994a).
[2] Recreation day = any portion of a 24-hr day spent hunting by one person.

Table 3.37 Visual Resource Management Class Objectives.

Class	Description
I	Preserve the existing character of the landscape; although this class provides mainly for natural ecological change, limited development activity may be allowed in some areas, if the level of change to the characteristic landscape is very low and nearly unnoticeable. This class includes primitive (wilderness) areas, some natural areas, wild sections of national wild and scenic rivers, and other congressionally and administratively designated areas where decisions have been made to preserve a natural landscape.
II	Retain the existing character of the landscape; management activities may be seen, but should not attract the attention of the casual observer. Changes to the characteristic landscape should be low, and changes must repeat the basic elements (i.e., form, line, color, texture) found in the predominant natural features of the existing landscape.
III	Partially retain the existing character of the landscape; moderate changes to the existing landscape are allowed, although management activities associated with these changes should not dominate the view of the casual observer. As in Class II, changes should repeat the basic elements of the characteristic landscape.
IV	Provide for management activities that require major modification of the existing character of the landscape. Although management activities may dominate the view and be the major focus of viewer attention, every attempt should be made to minimize the impact of these activities through careful location selection, minimal disturbance, and repetition of the basic elements of the characteristic landscape. The relative change to the characteristic landscape can be high.



Map 3.23 Locations of BLM Visual Management Classes and Distance Zones Within the KPPA.

Table 3.38 Visual Resource Management Classes and Distance Zones, Foote Creek Rim and Simpson Ridge Project Areas.

Area/VRM Class	Distance Zone	Acreage	Percent of Area
Foote Creek Rim Project Area			
III	Foreground-middleground	4,642	93
	Background	0	0
	Seldom-seen	358	7
IV	--	0	0
Total		5,000	100
Simpson Ridge Project Area			
III	Foreground-middleground	21,156	39
	Background	0	0
	Seldom-seen	32,360	59
IV	Foreground-middleground	886	2
	Background	0	0
	Seldom-seen	491	<1
Total		54,893	100
Total of Both Areas			
III	Foreground-middle ground	25,798	43
	Background	0	0
	Seldom-seen	32,718	55
IV	Foreground-middle ground	886	1
	Background	0	0
	Seldom-seen	491	<1
Total		59,893	100

Table 3.39 Scenic Quality Inventory and Evaluation Chart.

Key Factors	Score and Rating Criteria		
Landform	(5) High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops; or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers	(3) Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting, though not dominant or exceptional	(1) Low rolling hills, foothills; or flat valley bottoms; or few or no interesting landscape features
Vegetation	(5) A variety of vegetative types as expressed in interesting forms, textures, and patterns	(3) Some variety of vegetation, but only one or two major types	(1) Little or no variety or contrast in vegetation
Water	(5) Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape	(3) Flowing or still, but not dominant in the landscape	(0) Absent or present, but not noticeable
Color	(5) Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snowfields	(3) Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element	(1) Subtle color variations, contrast, or interest; generally muted tones
Influence of adjacent scenery	(5) Adjacent scenery greatly enhances visual quality	(3) Adjacent scenery moderately enhances overall visual quality	(1) Adjacent scenery has little or no influence on overall visual quality
Scarcity	(5+)[1] One of a kind; or unusually memorable; or very rare within region; consistent chance for exceptional wildlife or wildflower viewing, etc.	(3) Distinctive, though somewhat similar to others within the region	(1) Interesting within its setting, but fairly common within the region
Cultural modifications	(2) Modifications add favorably to visual variety while promoting visual harmony	(0) Modifications add little or no visual variety to the area, and introduce no discordant elements	(-4) Modifications add variety, but are very discordant and promote strong disharmony

Scenic Quality Rating (described in text):
A = Total score of 19 or more.
B = Total score of 12-18.
C = Total score of 11 or less.

[1] A rating of greater than 5 can be given, but must be supported by written justification.

view). Well-vegetated riparian corridors (e.g., the Medicine Bow River) also enhance scenic quality.

Landscapes within the VRM classification system are subdivided into three distance zones (i.e., foreground-middleground, background, and seldom-seen areas) based on relative visibility from travel routes or observation points (BLM 1986). The foreground-middleground zone includes areas seen from highways (e.g., Wyoming Highway 13) or other viewing locations that are less than 5 mi (8 km) away. Areas seen beyond the foreground-middleground zone that are less than 15 mi (24 km) away are in the background zone. Areas that are not seen in the foreground-middleground or background zones are in the seldom-seen zone (i.e., hidden from view).

Distance zones were mapped by Mariah during a driving survey of the major roads within and adjacent to the KPPA (i.e., I-80 and Wyoming Highways 30/287, 72, and 13). Ninety-three percent (4,642 ac) of Foote Creek Rim is within the foreground-middleground zone (Table 3.38, Map 3.23) and 7% (358 ac) are within the seldom-seen zone. All of Foote Creek Rim is VRM Class III. Approximately 22,042 ac of the Simpson Ridge area are in the foreground-middleground zone, and 32,851 ac are within the seldom-seen zone. Of the acreage in the foreground-middleground zone, 25,798 ac are VRM Class III and 886 ac are VRM Class IV. Because of the hilly landscape, none of the KPPA is within the background zone.

All three transmission line routes are within VRM Class III areas. Seventy-four percent of Alternate 3 is within the seldom-seen zone, as is 24% of Alternate 1 and 75% of Alternate 2 (Table 3.40). Four mi of Alternate 3 would be visible from Wyoming Highways 30/287 and 72. Twenty mi of Alternate 1 and 9 mi of Alternate 2 would be visible from I-80 and Wyoming Highways 30/287 and 72.

Viewer sensitivity, another variable affecting visual resource management, is a measure of public concern for scenic quality; therefore, sensitivity is implicit in the VRM classification of the KPPA. Sensitivity depends on the number and attitudes of viewers. In the vicinity of the KPPA, higher sensitivity zones would occur along the interstate and highway corridors.

There has been little development within the KPPA. Existing development includes roads, pipelines, telecommunications lines, power lines, mines, and oil and gas development. This development has impacted the existing visual resources of the KPPA.

3.7 HAZARDOUS MATERIALS

KENETECH evaluated potential hazardous wastes within the Foote Creek Rim area using existing sources of information. The area was found to be free of obvious environmental degradation within the scope of the hazardous substances and petroleum products identified in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. Potential sources of future contamination would include:

- Spills or leaks from one petroleum product pipeline and/or four natural gas pipelines crossing the site.
- Migration of hazardous substances or petroleum products onto the site from a potential source on adjacent property. Property adjacent to the southern side of Foote Creek Rim was reported to have been effected in 1981 by a truck spill of 100 gal of amitrole herbicide onto the I-80 roadside, approximately ¼ mi west of Arlington, Wyoming.
- Spilling, leaking, and/or dumping of hazardous substances, and/or petroleum products associated with agricultural and livestock activities.
- Spilling, leaking, and/or dumping of hazardous substances, and/or petroleum products associated with mineral, coal, oil, and/or gas exploration and/or extraction.
- Other sources of contamination not currently obvious or identifiable.

Table 3.40 VRM Classes and Distance Zones, Alternate Transmission Line Routes.

Alternate Route	Distance Zone	Linear Distance (mi)	Percent of ROW
Alternate 1	Foreground-middleground	20	76
	Background	0	0
	Seldom-seen	6	24
Alternate 2	Foreground-middleground	6	25
	Background	0	0
	Seldom-seen	18	75
Alternate 3	Foreground-middleground	8	26
	Background	0	0
	Seldom-seen	22	74
Alternates 1 & 2[1]	Foreground-middleground	1	N/A
	Background	0	N/A
	Seldom-seen	0	N/A
Alternates 1-3[1]	Foreground-middleground	<1	N/A
	Background	0	N/A
	Seldom-seen	0	N/A

[1] These refer to the segments where the alternate routes merge near Hanna.

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Environmental consequences of construction, operation, and maintenance of the proposed Windplant project are discussed below for each potentially affected resource under each alternative. Discussions of impacts that can be reasonably expected from project implementation are included, and mitigation measures and residual impacts are discussed, where appropriate. Project-wide mitigation measures, presented in Section 2.1.11, are part of the Proposed Action and Alternative A, and impact analyses assume that these mitigation measures would be effectively implemented. Additional mitigation measures are recommended for some resources to further minimize impacts; however, the BLM lacks authority to enforce some of these measures on private lands. Nevertheless, KENETECH and PacifiCorp have committed to implementing the proposed project with public safety and environmental consciousness throughout the KPPA and for the LOP insofar as landowner preference and agreement allow.

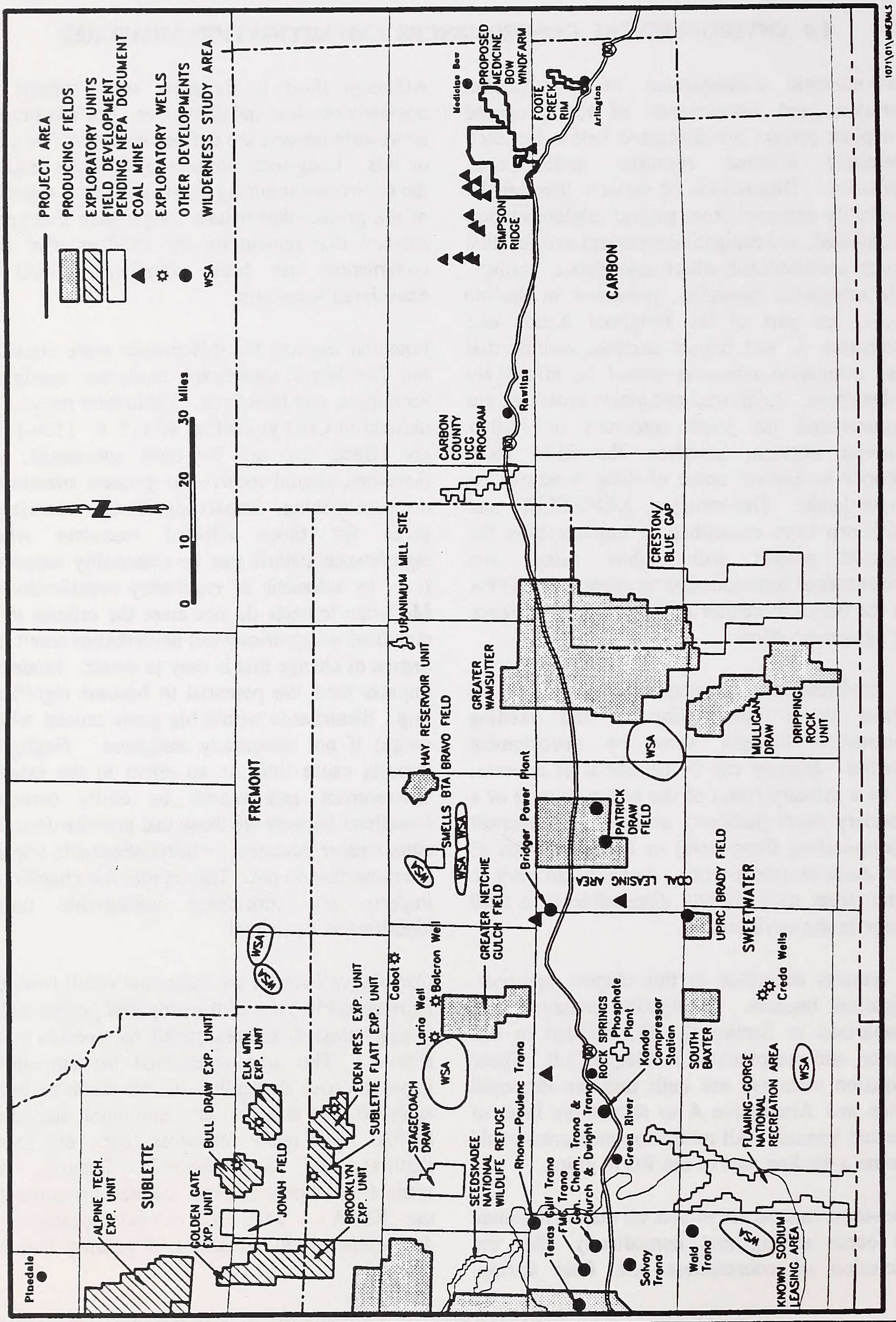
An environmental consequence or impact is defined as a modification of the existing environment brought about by development activities. Impacts can be beneficial or adverse, can be a primary result of the action (direct) or a secondary result (indirect), and can be permanent or long-lasting (long-term) or temporary and of short duration (short-term). Impacts can vary in degree from only slightly discernible to a total change in the environment.

All impacts described in this chapter are post-mitigation impacts. Mitigation measures are summarized in Section 2.1.11, detailed in this chapter, and recapitulated in Chapter 5.0. These mitigation measures are built into the Proposed Action and Alternative A to reduce the level of expected impacts. All mitigation measures would become a binding part of the ROW grant.

Short-term impacts are effects on the environment that occur during and immediately after the conclusion of construction and final testing. Although short in duration, such impacts are normally obvious and disruptive. For this project, short-term impacts are defined as lasting five years or less. Long-term impacts are changes made in the environment during construction and operation of the project that remain longer than five years. Impacts that remain for the LOP or after final reclamation has been completed would be considered long-term.

Potential impacts for this project were classified into five levels: significant, moderate, negligible, no impact, and beneficial. Significant impacts (as defined in CEQ guidelines 40 C.F.R. 1500-1508) are effects that are the most substantial, and therefore, should receive the greatest attention in decision-making. Impact significance criteria are given for those affected resources where significance criteria can be reasonably supported (i.e., by scientific or regulatory considerations). Moderate impacts do not meet the criteria to be classified as significant but nevertheless result in a degree of change that is easy to detect. Moderate impacts have the potential to become significant (e.g., disturbance within big game crucial winter range) if not adequately mitigated. Negligible impacts cause little or no effect to the existing environment and cannot be easily detected. Beneficial impacts are those that provide desirable situations or outcomes, while undesirable impacts are those that do not. Throughout this chapter, all impacts are considered undesirable unless identified as beneficial.

Cumulative impacts are those that result from the incremental impacts of the proposed project added to past, present, and reasonably foreseeable future actions. The area considered for cumulative impacts varies depending on the resource being analyzed, but includes, at a minimum, the entire KPPA. For many resources (e.g., big game, raptors) and socioeconomic impacts, the cumulative impact analysis includes areas outside the KPPA. Map 4.1 shows locations of developments in southern Wyoming that are



Map 4.1 Map of Proposed and Existing Development in Southern Wyoming.

mentioned in the cumulative impacts analysis presented in this chapter.

Cumulative impacts are described for each resource. The analysis is based on existing information available for past, present (i.e., the proposed project), and reasonably foreseeable future developments in and adjacent to the KPPA. The only reasonably foreseeable project in the area is the possible development of a windfarm near Medicine Bow. An application to use approximately 10 sections of public land for windfarm development has been received by the BLM. This project would occupy approximately 13,440 ac; total disturbance is expected to be 1,344 ac.

Past use of the KPPA has included livestock and wildlife grazing and foraging, gas and oil development and production, coal mining, recreation, and transportation. These uses, except for coal mining, continue through the present and are anticipated to continue into the reasonably foreseeable future. The extent of existing and proposed disturbance within the KPPA under the Proposed Action and Alternative A is presented in Tables 2.1(a) and 4.1. The maximum total acreage disturbed by the proposed project would be 1,787 ac initially and 715 ac for the LOP.

Surface coal mining in the Hanna Basin, approximately 5 mi (8 km) north of the KPPA, has disturbed approximately 18,180 ac, which is considered in the analysis of cumulative impacts for some resources (e.g., air quality, vegetation, soils, land use, wildlife). While many of the mines are nearing the end of their economic life or are almost fully reclaimed, some mining will continue in the near future. Approximately 12,439 ac have been reclaimed, leaving 5,741 ac disturbed. Since potential future surface and subsurface coal mine expansions beyond currently permitted levels cannot be adequately quantified, future coal mine-related disturbances shall, for the purpose of this analysis, be considered limited to currently permitted levels, or 22,598 ac.

The No Action Alternative would require the BLM to deny issuance of a ROW grant. This alternative would essentially maintain the existing condition of the environment within the KPPA. No immediate impact to the existing environment would occur because no additional ground would be disturbed. The No Action Alternative is not expected to result in direct development of another energy source within the KPPA, the GDRA, or the area serviced by BPA, PacifiCorp, Tri-State, PSCo, or EWEB (Section 2.3).

Impacts of the Proposed Action, Alternative A, and No Action, and mitigations for development activities are summarized in Table 2.11 and discussed in detail below.

4.1 PHYSICAL RESOURCES

4.1.1 Climate and Air Quality

4.1.1.1 Significance Criteria

Significance criteria for impacts on climate were not established because no climatic impacts are expected [except indirectly through beneficial air quality impacts (see Section 4.1.1.2, Air Quality)]. However, impacts on snow distribution are discussed in this section due to possible moderate impacts on other resources (i.e., geologic hazards, soils, hydrology, vegetation, and wildlife).

Impacts to air quality would be considered significant if project activities result in a violation of federal and/or state air quality attainment standards (WDEQ 1989).

4.1.1.2 Proposed Action

Climate. Because appropriate snow removal methods would be used to minimize or prevent berming along roads, direct impacts of snow redistribution would probably be negligible for the first phases of development but could be moderate for the full 500-MW Windplant. Three direct impacts on snow accumulation patterns resulting from Windplant development are possible (Tabler and Associates 1994):

Table 4.1 Proposed and Existing Disturbance Within the KPPA.

Proposed Disturbance	Phase I 70.5 MW		Foote Creek Rim 200 MW		Simpson Ridge 300 MW		Full Windplant 500 MW		Alternative A 300 MW	
	New	LOP	New	LOP	New	LOP	New	LOP	New	LOP
Total	319	68	553	176	1,234[1]	539	1,787	715	1,146	431

Existing Disturbance	Foote Creek Rim Area (ac)	Simpson Ridge Area (ac)	Alternate 1 (ac)	Alternate 2 (ac)	Alternate 3 (ac)	Total
Roads[2]	4	154	2	2	4	166
Pipelines[3]	12	229	<1	<1	<1	241
Telephone cable[3]	22	0	<1	0	0	22
Oil & gas wells[4]	3	0	2	0	5	10
Total	41	383	4	2	9	439

1 Does not include disturbance due to the 230-kV transmission line or Miner's substation expansion because these disturbances would occur during the development of Phase I.
2 Assumes an average road disturbance width of 48 ft (14.6 m).
3 Assumes a 50 ft (15.2 m) initial disturbance width.
4 Assumes a 1.5 ac disturbance area per well and includes active wells only.

- increased snow accumulation within and downwind of WTG arrays,
- localized snowdrifts formed by ancillary structures (e.g., downtower boxes, padmounted transformers, security fences), and
- snowdrifts caused by roads and snow-plowing operations.

Indirect impacts would occur due to the effects of snow distribution on geologic hazards (Section 4.1.4), soils (Section 4.1.6), hydrology (Section 4.1.7), vegetation (Section 4.2.1), and wildlife (Section 4.2.3).

Wind turbine arrays could increase the overall snow cover in the developed area. A single row of operating turbines constitutes a porous barrier that reduces wind speeds and surface shear stress for some distance downwind, which could cause increased snow deposition downwind of turbine strings. The effect on snow cover would depend on the geometry and aerodynamic resistance of the WTG array (Tabler and Associates 1994).

When stationary, the WTG blades would not constitute a large area to slow windspeeds. However, the drag of the turning rotor would be proportional to the swept area (Hoerner 1965), and with 108-ft (33-m) diameter blades sweeping 9,200 ft^2 (855 m^2) at a spacing of 162 ft (49 m) apart, the ratio of disturbed vs. undisturbed airflow is approximately 0.42, exclusive of the support towers (Tabler and Associates 1994). The wake generated by a single string of WTGs on an 80-ft (24-m) tower would reach the ground at approximately 3.7 rotor diameters [400 ft (122 m)] downwind. Wakes from individual WTGs would coalesce at approximately 4.0 blade diameters, or at approximately the same distance, downwind. The potential drift created by a single string would extend beyond the point of coalescence approximately 2,800 ft (853 m), or approximately 35 times the height of the towers (Tabler 1986). Although the location and the extent of the affected area can be estimated from the above relationships, it is not possible to predict the depth of snow accumulation, or even determine if it would be detectable. Factors such as snowfall, blowing, and evaporation would influence the possible development of downwind drifts.

The effects of two or more rows of WTGs spaced 1,080 to 1,620 ft (329 to 494 m) apart could have a combined effect greater than that of a single row. Scale model tests or full-scale observations would be required to determine effects of multiple rows on snow distribution. Based on preliminary analysis of aerodynamic drag data provided by KENETECH, it is likely that snow would accumulate between arrays, especially arrays of four or more rows of turbines (Tabler and Associates 1994).

In addition to possible snow deposition within and downwind from WTG arrays, horseshoe-shaped snow drifts will form around tower bases [base of each leg is approximately 11.0 ft (3.4 m) in diameter]. The size and shape of drifts in the vicinity of the WTGs will depend on the placement of downtower boxes. The overall drift would be smaller if downtower boxes are incorporated into the base of the tubular support or located on the downwind side, as opposed to being located alongside the tower base.

The size of a drift formed by a solid three-dimensional rectangular object varies with its height and width. A key-hole shaped bare area would extend around and downwind of the downtower boxes and padmount transformers, bordered by wing-shaped drifts that would extend for considerable distances downwind. Maximum depth of these drifts is expected to be about 3 ft (1 m). The total mass of snow stored in these drifts would represent only a small fraction of the total snow transport across the project area.

Drifts caused by downtower facilities could obstruct vehicular travel on downwind service roads. If drifts across roads are disturbed due to traffic or plowing, the resulting berms along the roadsides could induce snow deposition, which in turn, could cause drifts to grow in depth and lateral extent.

Significant snow accumulation may occur both upwind and downwind from chain-link fences such as those that would be used to fence Windplant substations. These drifts may affect traffic on adjacent service roads.

If roads are properly designed and maintained as described below, service roads paralleling turbine strings would have a negligible or moderate impact on snow distribution. Potentially significant impacts would occur if roads are improperly designed and maintained. Slow-moving snow removal equipment, such as graders, could form berms along the roadside that would be traps for blowing snow; these drifts typically grow rapidly as subsequent snow removal operations increase their height. Where feasible, roads would be plowed in a downwind direction using a wing plow to reduce the height of snow berms. Because snow particles freeze together, disturbed snow hardens, and thus becomes resistant to wind erosion. Roads would be elevated above surrounding terrain, wherever possible, so that wind would keep roads relatively free from snow accumulation and encroachment of horseshoe-shaped drifts formed by tower bases and downtower facilities would be minimized. Even in the absence of snow removal operations, vehicles driving through newly fallen snow can initiate subsequent drifting problems because tires form ridges that resist wind erosion and induce snow deposition.

Air Quality. A recent analysis of resource acquisition by Pacific Northwest Utilities showed that between 1989 and 1994, negotiations were completed for 1,276.5 average MW of new resources. Natural gas-fired generation projections accounted for 84% of the total (Conservation Monitor 1994). If this trend continues, there appears to be at least an 84% probability that if the Windplant project is not constructed, its output will be replaced by new gas-fired generation emitting large amounts of carbon dioxide (CO_2).

Using windpower instead of burning fossil fuels to generate electricity would have "beneficial" impacts on air quality because greenhouse gases and other pollutants emitted by conventional fossil fuel combustion would not be produced. The term beneficial is used to describe the favorable impact of using a nonpolluting resource to generate electricity; it is not intended to reflect proactive air quality improvement (i.e., cleanup). In the U.S., annual CO_2 emissions due to fossil fuel burning totaled 5.7 billion tons (5.1 billion metric tons) in 1989; sulfur dioxide (SO_2) emissions in 1990 totaled 15.6 million tons (14.2 million metric tons), and NO_x emissions totaled 8.0 million tons (7.3 million metric tons) (Table 4.2). These pollutants, among others, create biological hazards including, but not limited to, direct human health effects, acid deposition, and potential global warming. Compared with an oil-burning power plant (generating 500 MW of electricity), the proposed 500-MW Windplant would prevent the release of 1.0 million tons (0.9 million metric tons) of CO_2, which is 0.018% of annual U.S. CO_2 emissions; 573.0 tons (520.0 metric tons) of SO_2 (0.004%), and 716.0 tons (649.7 metric tons) of NO_x (0.009%). Comparing wind with gas- and coal-fired plants, similar reductions in pollutant emissions would occur (Table 4.2). These reductions are some of the principal benefits of using non-polluting resources for electricity generation, and result in a beneficial impact.

In addition to the biological costs of pollution, society is bearing a substantial economic cost. The costs of pollution are difficult to quantify but include additional health care, development and utilization of pollution prevention devices (i.e., SO_2 scrubbers for coal-fired plants), and programs to reduce emissions (e.g., the Acid Deposition Control Program). Costs to society for several major pollutants, estimated by the Public Utility Commission of California, are shown in Table 4.3 (SMUD 1993). The 500-MW Windplant could result in a cost savings of $26.0 million to $331.1 million per year over oil-, gas-, and coal-fired power plants.

In the KPPA, short-term increases in particulate dust and trace gas emissions would result from construction and O&M activities; however, the project would remain in compliance with

Table 4.2 Estimated Reduction in Pollutant Emissions and Comparison with U.S. Annual Emissions from Man-made Sources.

Pollutant	Annual U.S. Emissions[1,2] Tons	Metric Tons
SO_2 (Electric utilities, 1990)	15,600,000	14,156,000
CO_2 (Fossil fuel burning, 1989)	5,662,076,000	5,138,000,000
NO_x (Electric utilities, 1990)	8,000,000	7,256,000

	Reduction in Emissions		% of Annual U.S. Emissions	LOP Emissions Reductions	
	Tons/Year	Metric Tons/Year		Tons	Metric Tons
Wind vs. an oil-fired plant[3]					
SO_2 (Electric utilities, 1990)	573	520	0.004	17,190	15,599
CO_2 (Fossil fuel burning, 1989)	1,003,000	910,163	0.018	30,090,000	27,304,899
NO_x (Electric utilities, 1990)	716	650	0.009	21,480	19,492
Wind vs. a gas-fired plant[3]					
SO_2 (Electric utilities, 1990)	n.d.[4]	n.d	n.d.	n.d.	n.d.
CO_2 (Fossil fuel burning, 1989)	2,093,760	1,899,964	0.037	62,812,800	56,998,910
NO_x (Electric utilities, 1990)	260	236	0.003	7,800	7,078
Wind vs. a coal-fired plant[5]					
SO_2 (Electric utilities, 1990)	12,500	11,343	0.080	375,000	340,290
CO_2 (Fossil fuel burning, 1989)	1,500,000	1,361,161	0.026	45,000,000	40,834,845
NO_x (Electric utilities, 1990)	3,750	3,403	0.047	112,500	102,087

[1] National Acid Precipitation Assessment Program (1993).
[2] U.S. Congress (1991).
[3] SMUD (1993).
[4] n.d. = No data.
[5] Personal communication, June 1994, with Bruce Morely, KENETECH.

Table 4.3 Estimated Reduction in Pollutant Emissions and Environmental Costs by Operation of a 500-MW Windplant Compared with Oil-, Gas-, and Coal-fired Plants.

Pollutant	Reduction in Emissions: Tons/Year	Reduction in Emissions: Metric Tons/ Year	Cost/Ton (dollars)	Annual Cost (dollars)
Wind vs. an oil-fired plant[1]				
SO_2	573	520	18,300	10,485,900
CO_2	1,003,000	910,163	7	7,021,000
NO_x	716	650	24,500	17,542,000
CO	50	45	920	46,000
PM10	100	91	5,300	530,000
Reactive organic gases	38	34	17,500	665,000
Total Annual Cost Reduction				36,289,900
Wind vs. a gas-fired plant[1]				
SO_2	n.d.	n.d.	18,300	n.d.
CO_2	2,093,760	1,899,964	7	14,656,320
NO_x	260	236	24,500	6,370,000
CO	180	163	920	165,600
PM10	210	190	5,300	1,113,000
Reactive organic gases	210	190	17,500	3,675,000
Total Annual Cost Reduction				25,979,920
Wind vs. a coal-fired plant[2]				
SO_2	12,500	11,343	18,300	228,750,000
CO_2	1,500,000	1,361,161	7	10,500,000
NO_x	3,750	3,403	24,500	91,875,000
CO	n.d.	n.d.	920	n.d.
PM10	n.d.	n.d.	5,300	n.d.
Reactive organic gases	n.d.	n.d.	17,500	n.d.
Total Annual Cost Reduction				331,125,000

[1] SMUD (1993).
[2] Personal communication, June 1994, with Bruce Morely, KENETECH.

Wyoming Air Quality Standards and Regulations and the Clean Air Act. Construction impact would be moderate, and LOP impacts would be negligible. The WDEQ-AQD reviewed the project description and determined that no air quality construction permit would be required to construct and operate the proposed Windplant (personal communication, December 1994, with Charles Collins, WDEQ-AQD).

O&M particulate emissions from pickup trucks traveling on gravel roads were estimated using the AP-42 Section 11.2.1 emission factor for unpaved roads (EPA 1993). The calculations are sensitive to the estimated silt content in the gravel used for the road surface. Because the gravel source for road surfaces in the KPPA is, as yet, undetermined, precise silt content is not available. A value of 5.1% silt was measured along a haul road in southwestern Wyoming. To be conservative, a value of 10% silt was used to make the estimates herein. It was estimated that there would be 59,370 vehicle mi (95,544 km) traveled per year for the first phase, and 249,354 mi (401,285 km) per year for the 500-MW Windplant (personal communication, January 1995, with Marci Proutt, KENETECH). Emissions would be controlled using an approved suppressant (i.e., petroleum resin) with a control factor of about 80%. Application of approximately 0.2 gal/m^2 (0.8 liters/m^2) would control dust emissions from gravel roads within the KPPA by about 80% (EPA 1993). Using these approximations, particulate emissions from the first phase O&M would be 16.6 tons (15.1 metric tons) per year TSP and 7.0 tons (6.4 metric tons) per year of particulates $\leq$ 10 microns (PM10). For O&M of the 500-MW Windplant, TSP emissions would total 69.4 tons (63.0 metric tons) per year and PM10 emissions would total 31.2 tons (28.3 metric tons) per year.

Hydrocarbons, NO_x, CO, CO_2, and SO_2 emissions in the KPPA would temporarily increase during construction and O&M. No CO_2 emissions exceeding suggested health practice standards [5,000 parts per million (ppm) annual average (American Council of Governmental Industrial Hygienists 1980)] would occur.

The occurrence of corona discharge from the 230-kV transmission line could result in production of gaseous effluents, including ozone and NO_x. However, transmission lines produce only very small amounts of these gaseous effluents (Miller and Kaufman 1978), and thus, air quality impacts from the transmission line would be negligible for the LOP and beyond.

Activities associated with the Proposed Action would not produce emissions that exceed Class II PSD increments, National Ambient Air Quality Standards, or Wyoming Ambient Air Quality Standards; and therefore, impacts to regional air quality would be moderate during construction and negligible for the LOP.

4.1.1.3 Alternative A

Climate. Under Alternative A, Windplant impacts on snow redistribution would be reduced by approximately 40% from the Proposed Action, depending upon facilities locations within the KPPA. If facilities are located in natural snow accumulation areas, impacts may not be reduced by the full 40%; conversely, because fewer turbines would be erected, it would be easier to avoid areas where impacts from snow deposition would cause moderate or significant impacts.

Air Quality. Construction of a 300-MW Windplant would result in a reduction of between 30 tons and 1.3 million tons (27.2 metric tons-1.3 million metric tons) of common pollutants (Tables 4.2 and 4.3); i.e., the air quality benefits would be reduced by approximately 40% from the Proposed Action. Similarly, by reducing the savings in pollutants, economic benefits to society of using a non-polluting resource also would be reduced by approximately 40% (Table 4.3).

Because similar mitigation measures would be used under Alternative A as under the Proposed Action, impacts under this alternative would be moderate during construction and negligible to beneficial for

the LOP. In addition, since 556 fewer turbines would be erected (and fewer associated roads and distribution and communications lines), potential adverse air quality impacts would be reduced by about 40%. Vehicle miles traveled during O&M for Phase I would be the same as for the Proposed Action, but reduced to 149,612 mi (240,771 km) for the 300-MW Windplant. Suppressant measures similar to the Proposed Action would be used; therefore, TSP emissions under Alternative A would total 41.6 tons (37.7 metric tons) and PM10 emissions would total 18.7 tons (17.0 metric tons). Transmission line emissions also would be similar to the Proposed Action, and thus, negligible for the LOP.

4.1.1.4 No Action

Climate. Under the No Action Alternative, no impacts on snow distribution would occur.

Air Quality. Under the No Action Alternative, potential air quality benefits could be lost if the demand for electricity is met using fossil fuels. Therefore, the No Action Alternative could result in more fossil fuel combustion and the release of air pollutants. However, there would be no incremental increase in air quality impacts within the KPPA from the proposed project under the No Action Alternative.

4.1.1.5 Cumulative Impacts

Climate. Existing roads, residences, fences, oil and gas wells, and other developments are not sufficiently large or widespread to cause substantial snow accumulation; therefore, cumulative impacts from Windplant development on snow redistribution would be similar to impacts from the Proposed Action. The Medicine Bow windfarm, which borders the eastern edge of the Simpson Ridge area, would also cause snow redistribution and would add cumulatively to altered snow distribution patterns.

Air Quality. Parts of the U.S. and many other developed countries in the world are facing severe air pollution problems due to industrialization. Governments around the globe are instituting programs or setting goals to reduce pollution emissions and improve air quality (U.S. Congress 1991, Cogan 1992, National Acid Precipitation Assessment Program 1993). The U.S. currently emits about 20% of the world's CO_2, 40% of which comes from oil combustion, 34% from coal, and about 18% from natural gas (U.S. Congress 1991). If current practices continue, estimated CO_2 emissions would increase to 7.6 billion tons (6.9 billion metric tons) annually by the year 2015 (Figure 4.1). By implementing moderate or strict emission control measures, this amount could be substantially reduced. Moderate measures would include, for example, tree planting, conservation measures (e.g., better building insulation, heating and cooling efficiency, improved automobile efficiency, streamlined traffic patterns, ride-sharing), and electric utility improvements (e.g., better efficiency in fossil fuel-fired plants, upgraded hydroelectric plants, ***utilization of non-fossil fuel resources***, and application of CO_2 emission standards) (U.S. Congress 1991). Strict measures would be similar, but a greater reduction (as a percent of current levels) would be targeted. While none of these measures individually would amount to target reductions, the cumulative effects of combined measures would substantially reduce emissions in the U.S.; the proposed Windplant would contribute to annual reductions (Table 4.2). The effects of 30 years of Windplant operation would amount to an emissions reduction of 30.0-62.8 million tons (27.3-57.0 million metric tons) of CO_2 compared with coal, oil, or gas.

While the U.S. and other developed countries already face regional pollution problems and are implementing programs to improve air quality, other countries such as China and Russia are only beginning to develop their coal reserves, and may soon surpass U.S. emissions (U.S. Congress 1991). A major contributor to the observed increases in global atmospheric CO_2 concentrations (Figure 4.2) (and other gases, including greenhouse gases) is coal combustion, which produces more CO_2 than other fossil fuels. The effects of greenhouse gases [e.g., CO_2,

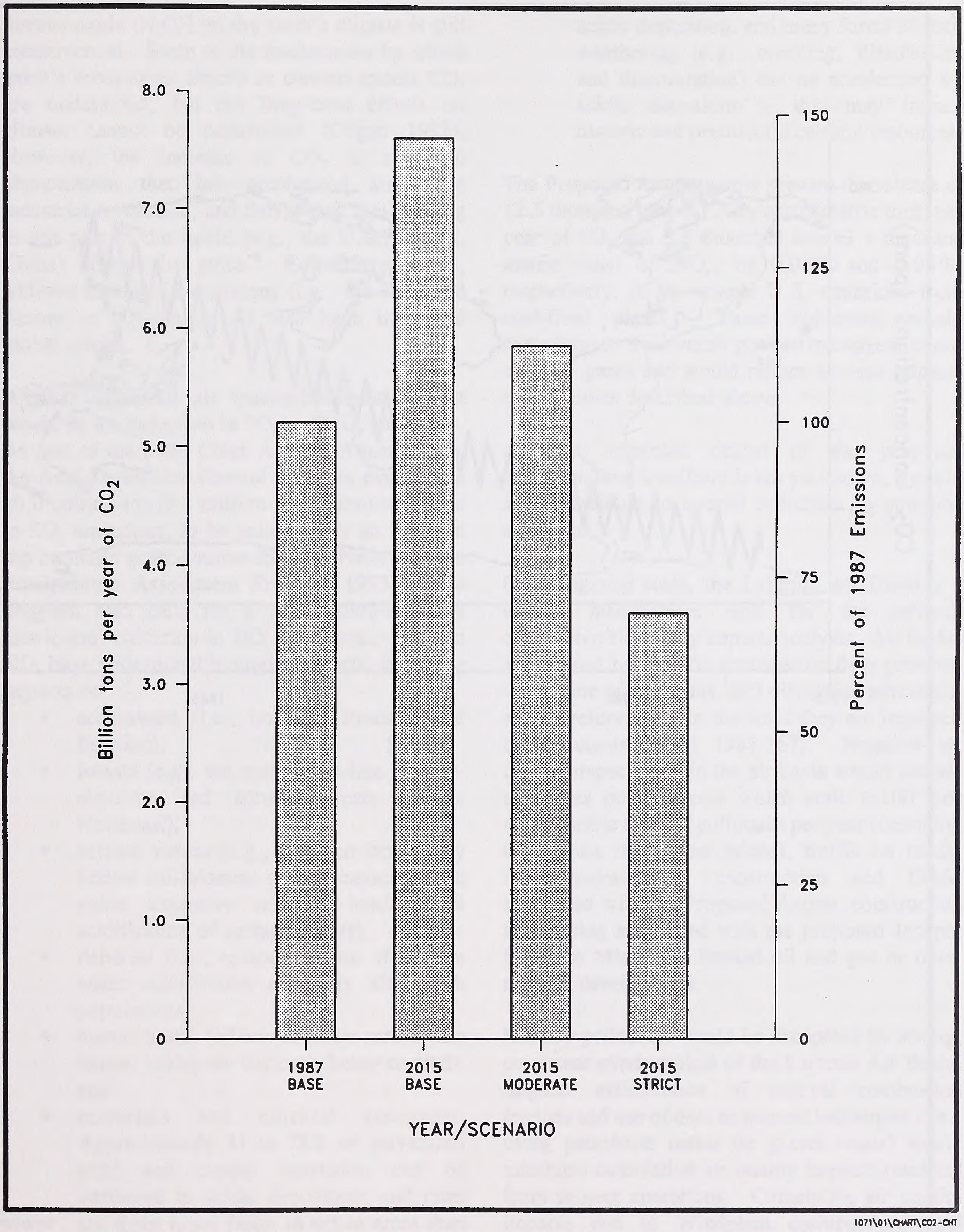


Figure 4.1 1987 U.S. CO_2 Emissions; 2015 Projected Emissions Without Controls, with Moderate Controls, and with Strict Controls.

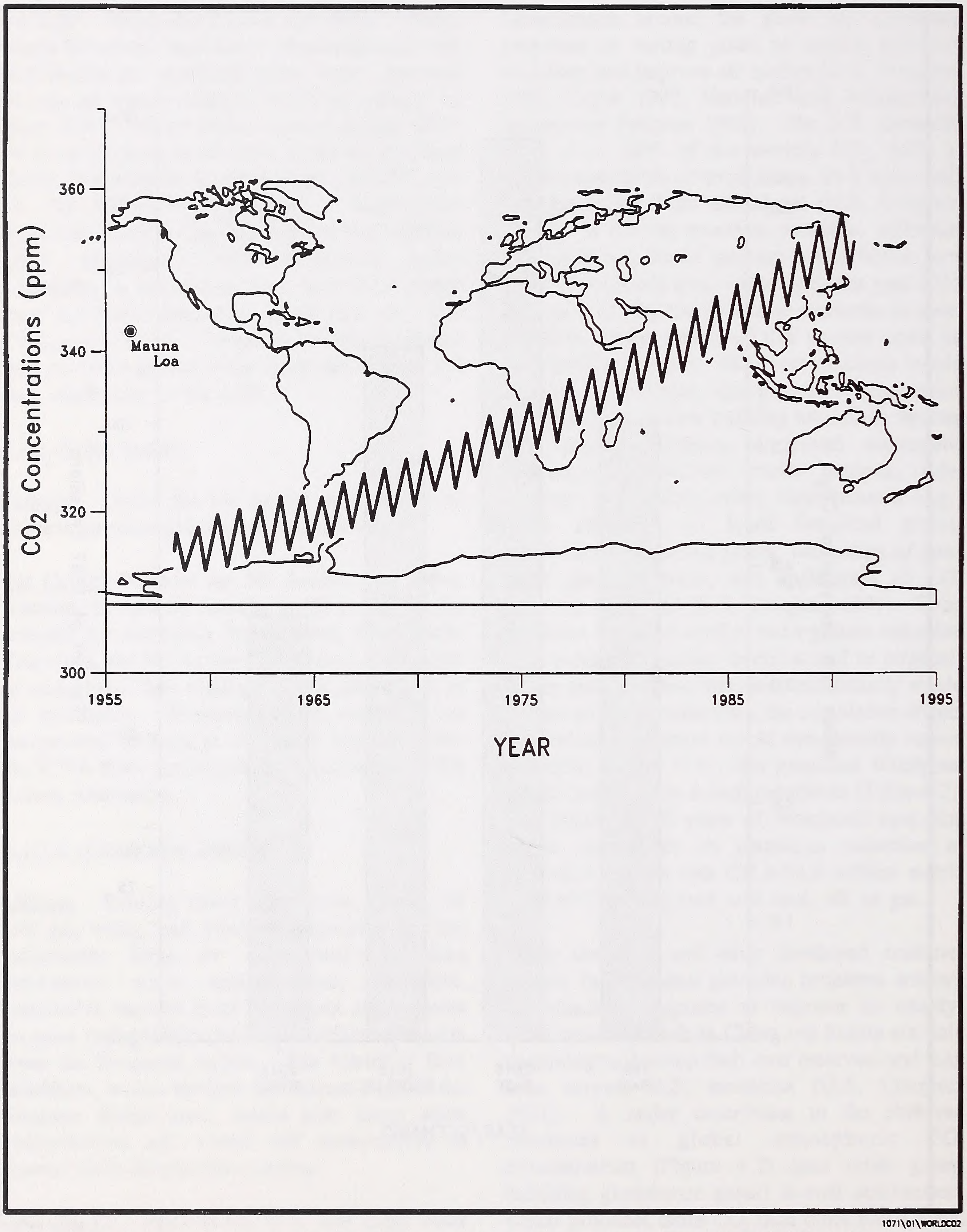


Figure 4.2 Monthly Atmospheric CO_2 Concentrations, Mauna Loa, Hawaii (Modified from Cogan 1992).

nitrous oxide (N_2O)] on the earth's climate is still controversial. Some of the mechanisms by which earth's ecosystems absorb or convert excess CO_2 are understood, but the long-term effects on climate cannot be determined (Cogan 1992). However, the increase in CO_2 is a global phenomenon that has accelerated since the industrial revolution, and thus, fossil fuel burning in one part of the world (e.g., the U.S., Russia, China) affects the globe. Conversely, small, additive savings in emissions (i.e., the Proposed Action or Alternative A) also have beneficial global effects.

Another beneficial air quality/biological impact would be the reduction in SO_2 and NO_x emissions. As part of the 1990 Clean Air Act Amendments, the Acid Deposition Control Program mandates a 10.0 million-ton (9.1 million-metric ton) reduction in SO_2 emissions, to be achieved by an imposed cap on major point-sources for SO_2 (National Acid Precipitation Assessment Program 1993). The program also calls for a 2.0 million-ton (1.8 metric-ton) reduction in NO_x emissions. SO_2 and NO_x have widespread biological effects, including impacts on:

- ecosystems (i.e., on their structure and function);
- forests (e.g., the marked decline of high-elevation red spruce forests in the Northeast);
- surface waters (e.g., nitrogen inputs may exceed soil/biomass storage capacities and cause excessive nutrient leaching or acidification of surface waters)
- fisheries (i.e., episodic pulses of surface water acidification adversely affect fish populations);
- human health (effects of acidic aerosols on human health are currently being studied); and
- materials and cultural resources. Approximately 31 to 78% of galvanized steel and copper corrosion can be attributed to acidic deposition, and rates are three times faster in urban areas than in rural areas. Automobile finishes, exterior paints, etc. are also affected by acidic deposition, and many forms of rock weathering (e.g., cracking, dissolution, and discoloration) can be accelerated by acidic deposition -- this may impact historic and prehistoric cultural resources.

The Proposed Action would prevent the release of 12.5 thousand tons (11.3 thousand metric tons) per year of SO_2 and 3.8 thousand tons (3.4 thousand metric tons) of NO_x, or 0.08% and 0.05%, respectively, of the annual U.S. emissions from coal-fired plants. These reductions would contribute to the overall goal to reduce emissions of these gases and would reduce adverse impacts on resources described above.

Although expected output of the proposed Medicine Bow windfarm is not yet known, it could also contribute to overall reduction in pollution emissions.

On a regional scale, the Laramie Air Basin is a logical management unit for the adverse cumulative air quality impacts analysis. Air basins are defined by specific atmospheric flow patterns, ventilation mechanisms, and dispersion potentials, and therefore, vary in the ways they are impacted by pollutants (BLM 1987:167). Negative air quality impacts within the air basin would include numerous point-sources which emit ≥100 tons (≥91 metric tons) of pollutants per year (including the Hanna Basin coal mines), traffic on roads, road maintenance, construction and O&M associated with the Proposed Action, construction and mining associated with the proposed Jackpot Uranium Mine, and limited oil and gas or other mineral development.

Emitted pollutants would be dissipated by strong, persistent winds typical of the Laramie Air Basin. Regular maintenance of internal combustion engines and use of dust abatement techniques (i.e., using petroleum resins on gravel roads) would minimize cumulative air quality impacts resulting from project operations. Cumulative air quality impacts due to Windplant construction, coal mining in the Hanna Basin, the proposed Medicine Bow windfarm, and other developments would be

moderate during construction and negligible for the LOP. The nearest Class I area (Savage Run Wilderness) is 30 mi (48 km) away from the KPPA, and is not in the direction of prevailing winds; therefore, no air quality impacts to this area are anticipated.

4.1.2 Topography/Physiography

4.1.2.1 Significance Criteria

Impacts to topography would be considered significant if disturbance permanently inhibited or substantially altered surface drainage patterns. Substantial alterations would include, for example, head cutting and/or gully formation where none existed prior to development, inhibiting surface runoff to areas where wetlands or riparian areas depended on it, or other changes which substantially redirect surface runoff. Minor surface drainage alterations caused by road ditches, erosion control devices, temporary diversions, etc., would not be considered significant. This criterion is consistent with drainage protection goals established in the GDRA RMP (BLM 1987:61-63). Negligible or moderate impacts would result from modifications to the landscape (e.g., cuts and fills, roads). The physiography (i.e., the overall character and distribution of landforms and drainage patterns) of the KPPA would not be affected by the proposed project or any of the alternatives.

4.1.2.2 Proposed Action

Impacts to topography would be negligible for the LOP and beyond. Impacts resulting from the Proposed Action would be changes to the landscape due to cut-and-fill activities used to level turbine pads and to make roadbeds. Stream crossings also have the potential for impacting surface drainage. A total of 1,787 ac (3% of the KPPA) would be disturbed during construction, and 715 ac (1%) would remain disturbed for the LOP (Table 4.1).

During construction and O&M, temporary drainage devices (e.g., ditches, culverts, waterbars, checkdams) may be required to divert runoff around Windplant facilities, but overall drainage patterns would be preserved, where feasible. Temporary sediment ponds may be needed to collect stormwater runoff during construction. Where feasible, drainage from turbine pads, turbine string corridors, and other facilities (i.e., substations) would be reconstructed during initial reclamation. Roads would be constructed following specifications in *Section 9113, Road Standards Manual* (BLM 1985, 1991), which requires restoration of surface drainage patterns with culverts, ditches, or other means, during construction. Drainage devices would be maintained regularly to ensure proper operation for the LOP. Therefore, impacts to surface drainage would be moderate during construction and negligible for the LOP. Because all disturbance areas would eventually be reclaimed, there would be no permanent impact.

Minor topographic changes would occur due to cut-and-fill activities associated with Windplant construction. Where feasible, cut-and-fill areas used during construction (e.g., staging areas along the 230-kV transmission line) would be regraded to the approximate original contour during initial reclamation. During final reclamation, all facilities would be removed to at least 6 inches below ground level, and all disturbed areas would be recontoured and revegetated. Therefore, impacts to topography would be negligible for the LOP and beyond.

4.1.2.3 Alternative A

No significant impact to topography and physiography would occur under Alternative A, and impacts would be similar to those for the Proposed Action (i.e., negligible for the LOP and beyond), but reduced by approximately 40%. New cut-and-fill disturbance under Alternative A would total approximately 1,146 ac (2% of the KPPA), and total LOP disturbance would be 431 ac (<1%) (Table 4.1).

4.1.2.4 No Action

No significant impact to topography or physiography would occur under the No Action Alternative. Existing disturbance on the KPPA totaling 439 ac (<1%) would continue for current land uses.

4.1.2.5 Cumulative Impacts

Cumulative impacts to topography in the KPPA and surrounding areas would occur from existing, proposed, and potential future roads or coal, oil, gas or other development projects. Development within and around the KPPA has and would alter surface drainage patterns; whether or not these patterns are permanently altered and development, therefore, represents a significant impact, can be argued many ways. No development would substantially alter or inhibit drainage patterns; therefore, cumulative impacts would be moderate. Coal mines create the most substantial impacts to topography within the region. Surface coal mining typically results in an overall lowering of the ground surface and a change in the distribution of various landforms. Disturbance from the coal mines would eventually total 22,598 ac if the mines expand to their currently permitted levels. Disturbance due to Windplant development (1,787 ac initially and 715 ac for the LOP) would be approximately 8% of the projected mining disturbance (3% for the LOP). The construction of 653.0 mi (1,050.9 km) of new roads for the 500-MW Windplant (Table 2.1a) would constitute a 400% increase in the miles of roads in the KPPA. Windplant roads would be constructed to BLM standards, including provisions for maintaining surface drainage; therefore, road development would not constitute a significant cumulative impact to topography. Construction of the Medicine Bow windfarm would also contribute to altered drainage patterns on approximately 1,344 ac adjacent to the KPPA. Disturbance attributable to the Proposed Action (for the LOP), the coal mines, existing disturbance within the KPPA, and the proposed Medicine Bow windfarm totals 25,096 ac; cumulative impacts to topography would be moderate for the LOP, but negligible after reclamation.

4.1.3 Mineral Resources

4.1.3.1 Significance Criteria

Impacts to mineral resources would be considered significant if access to existing permitted leases is restricted by the proposed project. This criterion is consistent with the mineral management goals specified in the GDRA RMP (BLM 1987:48-57). Moderate or negligible impacts would occur if access to economically recoverable resources is restricted.

4.1.3.2 Proposed Action

Because there are no active coal leases within the KPPA, the Proposed Action would not have a significant impact on coal resources. Recoverable reserves exist within the KPPA, but the potential for future coal mining is low (Section 3.1.3.1). The Windplant would preclude coal mining for the LOP such that if mining becomes economical during the LOP, moderate impacts to coal would occur.

The proposed project probably would not affect existing oil and gas extraction operations within the KPPA, and limited additional oil and gas development would probably not affect or be affected by the proposed project (i.e., impacts would be negligible). Oil and gas leases within the KPPA could be developed if facilities would not interfere with Windplant operation. The Windplant would limit the placement of oil and gas wells, pipelines, and other facilities. Windplant access roads, however, may provide some access to such developments. Future oil and gas development would depend on establishment of cooperative agreements between the Windplant owners, the proposed developers, and landowners. Alternate transmission line routes 1 and 3 each intersect one producing oil or gas field, but well locations would be avoided, and thus, impacts would be negligible for the LOP.

No detrimental impact to existing gravel quarry operations is anticipated from the proposed project. Gravel from quarries within and adjacent to the KPPA may be used for development and maintenance of roads. There are no active uranium leases within the KPPA, and the potential for uranium or other mineral development is low. Therefore, impacts from the Proposed Action on these mineral resources would be negligible.

4.1.3.3 Alternative A

Impacts to coal, oil, gas, and other mineral developments under Alternative A would be negligible and reduced by approximately 40% from those identified for the Proposed Action, since approximately 556 fewer WTGs would be erected. However, the potential for future conflicts between gas and oil recovery and coal mining would remain at a similar level of significance (i.e., moderate) to the Proposed Action.

4.1.3.4 No Action

No impact to mineral resources within the KPPA would occur under the No Action Alternative. However, an alternate energy resource, possibly fossil fuels, would be needed to compensate for the loss of power that would be generated by the Windplant. Under the No Action Alternative, negative impacts to fossil fuels could occur.

Fossil fuel extraction results in a significant, irretrievable loss of nonrenewable resources (BLM 1994d). Power generated by the 500-MW Windplant in one year would be equivalent to the burning of 2,388,100 bbls of oil or 11,320,000 mcf of gas (SMUD 1993). Conserving these reserves has two beneficial impacts. First, these resources would be available for future development to meet growing energy needs. Second, pollutant emissions caused by burning these resources would be delayed (see Section 4.1.1 for air quality impacts).

4.1.3.5 Cumulative Impacts

Cumulative impacts to oil, gas, and coal development would be negligible for the LOP and beyond. Limited oil and gas development would be possible within the KPPA for the LOP. Although coal mining is not anticipated in the near future, it may become economical prior to the cessation of windpower production, at which point, resource development conflicts would occur. Similar conflicts also would occur due to development of the proposed Medicine Bow windfarm. It is not known whether coal mining would become economical during the LOP, and thus, the magnitude of this potential impact cannot be evaluated. If the ROW easement is granted, KENETECH and PacifiCorp would have priority and would be allowed to continue Windplant development. Based on the oil and gas equivalency estimates provided by the SMUD (1993), beneficial impacts on fossil fuels from 500 MW of windpower generation could include the savings of approximately 72 million bbls of oil and 340 mmcf of gas over a 30-year LOP.

4.1.4 Geologic Hazards

4.1.4.1 Significance Criteria

Impacts to geologic hazards would be considered significant if project activities resulted in landslides, subsidence, increased flooding, or reactivation of sand dunes. Impacts to the project from geologic hazards would be significant if project facilities are damaged due to seismic events, landslides, subsidence, or flooding.

4.1.4.2 Proposed Action

Potential impacts to the project from geologic hazards are negligible for the LOP and beyond. Windplant facilities would be located to avoid abandoned underground mines; therefore, damage due to subsidence is unlikely. Alternates 1 and 2 each would cross approximately 1.0 mi (1.6 km) of mined-out areas and Alternate 3 would cross approximately 2.0 mi (3.2 km) of mined-out areas, but no subsidence is known to have occurred in

these areas. Mined-out areas would be inspected by a professional geologist or engineer prior to construction in these areas. Earthquake potential is very low, and thus, impacts from earthquakes are negligible. Facilities would be designed and constructed to Zone 4 Unified Building Code (UBC) standards, which would be more than adequate to withstand earthquakes of the magnitude expected to occur in Carbon County. Yellowstone Park is a Zone 4 area, where earthquake intensities would be expected to range from 8.0 to 9.0 on the Modified Mercali Scale; Carbon County is a Zone 1 area, where earthquake intensities would range from 6.0 to 7.0 (personal communication, September 1994, with James Case, WGS).

Areas prone to landslides or flooding would be avoided, wherever feasible; therefore, impacts from these hazards and the potential for increasing these hazards (i.e., causing landslides or flooding) would be negligible. If landslide areas must be disturbed, stringent erosion control and stabilization measures would be implemented throughout construction and O&M to minimize slope movement and reduce public safety risks. Additional Windplant-caused snow accumulation in landslide-prone areas also could cause landslides during spring snowmelt. Facilities would be located to avoid areas directly upwind of landslide areas, where feasible, to minimize snow accumulation on landslide areas (Section 4.1.1.1).

Construction in flood-prone areas will be completed during dry periods (e.g. late summer and fall), and facilities in these areas will be designed to withstand periodic floods. The transmission line would be constructed to span flood-prone areas, where feasible, and thus, there are no differences in impacts to/from flooding among the three alternate routes. None of the proposed routes crosses areas with landslide potential (Map 3.2).

While there are no known sand dunes in the area, removal of ground cover could result in severe erosion of windblown deposits, which could cause substantial soil loss and a decrease in productivity. Areas of windblown deposits would be avoided, where feasible, and all necessary disturbance in these areas would be reclaimed and stabilized as soon as practical, based on consultations with the BLM conducted during the POD process. Only Alternate 3 crosses areas where windblown deposits occur, but structures would be placed to avoid these deposits, where feasible, and thus, impacts to these deposits would be negligible. If any of these areas must be disturbed, stringent erosion control measures would be used and reclamation would occur promptly after construction; therefore, impacts would be negligible for the LOP and beyond.

4.1.4.3 Alternative A

Impacts on project activities from geologic hazards under Alternative A would approximate those for the Proposed Action (i.e., negligible for the LOP). Since Windplant development activities under Alternative A would be reduced by approximately 40% from the Proposed Action, there would be a similar reduction in potential impact levels. Impacts from transmission line construction would be identical to the Proposed Action (i.e., no significant impacts would occur) and there are no differences in impacts among the three alternate routes.

4.1.4.4 No Action

Under the No Action Alternative, no impacts to or from geologic hazards would occur.

4.1.4.5 Cumulative Impacts

There is widespread potential for disturbance of mined-out areas, sand dunes or windblown deposits, landslide areas, and floodplains within and around the KPPA. However, because geologic hazards would be avoided by all development projects wherever feasible, cumulative impacts due to/from geologic hazards would be negligible for the LOP and beyond. If geologic hazard areas on public lands cannot be avoided, detailed site-specific evaluations of potential impacts would be made and stringent

stipulations to protect public health and safety, as well as the resource to be affected, would be incorporated into the POD for that phase of development.

4.1.5 Paleontologic Resources

4.1.5.1 Significance Criteria

Impacts to paleontologic resources would be considered significant if important fossils were to be lost or destroyed. Loss or destruction may occur directly during construction, or indirectly due to private collection or vandalism. Beneficial impacts would include discovery of important fossils during predisturbance paleontologic surveys.

4.1.5.2 Proposed Action

The Class I paleontologic survey of Foote Creek Rim will be completed by a BLM-approved paleontologist and included in the FEIS for this project. Based on results of the Class I survey, BLM will determine if a Class III survey of proposed disturbance areas will be required (BLM 1993b). If it is required, the Class III survey results would also be included in the FEIS. Therefore, impacts to paleontolgical resources would be negligible for the LOP and beyond. Important paleontologic resources would either be avoided or recovered prior to construction in the KPPA. Because rock formations within the KPPA are known to contain fossils, monitoring during construction in certain areas may be required by the BLM to prevent accidental destruction of paleontological resources. If important fossils are discovered during construction, surface-disturbing activities at the site would cease until a BLM-approved paleontologist could evaluate the site and appropriate mitigation measures could be implemented.

Indirect impacts to paleontologic resources could occur from the loss of important fossil materials due to private collection or vandalism of newly exposed areas. Employee education about the value of these resources would minimize any indirect impacts. Beneficial impacts could result from the discovery and analysis of paleontologic resources during project implementation. Paleontologic resources discovered during project construction would be evaluated by a qualified paleontologist as deemed appropriate by the BLM, and significant features would be avoided or recovered prior to continuing construction activities.

Disturbance from transmission line construction would be slightly greater along Alternate 3 compared with the other two alternates, and Alternate 3 would pass within 0.25 mi (0.40 km) of a known paleontologic locality. This locality, and any others found during surveying or construction, would be avoided. Because all three alternate routes cross formations rated by the BLM as having significant or important fossil resources (i.e., the Hanna, Ferris, Wind River, and Mesaverde Formations and Miocene rocks) each has similar potential for encountering significant paleontologic resources.

4.1.5.3 Alternative A

Because the same mitigation measures would be used to prevent impacts to paleontologic resources under Alternative A as under the Proposed Action, impacts to these resources would be negligible or beneficial. The level of new ground disturbance under this alternative would also be reduced from approximately 1,787 ac for the Proposed Action to approximately 1,146 ac for Alternative A (Table 4.1), and thus, potential for impacting fossils would be reduced, but opportunities for fossil discovery would also be reduced.

4.1.5.4 No Action

No negative impacts to paleontologic resources would occur under the No Action Alternative. However, the potential for beneficial paleontologic discoveries would be lost.

4.1.5.5 Cumulative Impacts

The combined disturbance of the proposed Windplant and other proposed and existing developments in the region could uncover or destroy important fossils. All new development activities on public lands would be subject to stipulations promulgated in BLM guidelines for paleontologic surveys and evaluations and paleontologist qualifications (BLM 1993b). Adherence to these guidelines would prevent significant impacts to fossils throughout these combined project areas. Existing disturbance from coal mines, oil and gas developments, and roads must be cleared for paleontologic resources through WDEQ permitting, the Application for a Permit to Drill, or a ROW grant application, respectively. Therefore, impacts of past and future mineral developments on paleontologic resources in the cumulative impacts analysis area would be negligible or beneficial.

4.1.6 Soils

4.1.6.1 Significance Criteria

Impacts to soils would be considered significant if project activities resulted in noncompliance with stipulations in the PODs. PODs are developed on a site-specific basis and include provisions for:

- post-development land use;
- erosion control during construction, O&M, and reclamation;
- erosion control success standards; and
- revegetation success standards.

4.1.6.2 Proposed Action

Impacts to soils would be moderate during construction and negligible for the LOP. Phase I of the Proposed Action would impact 319 ac of soil during construction and 68 ac for the LOP (Table 4.1). Initial construction would effect approximately 227 ac of soils on nearly level to moderately steep uplands with 40 ac of disturbance for the LOP after initial reclamation. Soils on nearly level to gentle slopes on terrace remnants would have 88 ac disturbed initially, with 28 ac remaining disturbed after reclamation. Other soil disturbances would impact 3 ac of soils on ridges, sideslopes, and rough broken lands and 1 ac on nearly level to gently sloping alkaline alluvial soils. Soils would be reclaimed immediately after construction. Approximately 194 ac (4%) of the soils to be disturbed on the Foote Creek Rim area have severe wind erosion potential. All areas not utilized by construction or roads would be reclaimed immediately after construction, using approved methods.

The layout of the Simpson Ridge construction phase has not been determined, therefore, the types and amounts of soils that would be impacted remain unknown. Potentially sensitive soils would be avoided when feasible, but due to the widespread occurrence of soils with severe erosion potential, especially in the Simpson Ridge area, not all sensitive soils could be avoided. Sensitive soils are subject to severe wind erosion when vegetative cover is removed. Because winds within the KPPA are strong and persistent, windblown deposits and other unstable soils would only be disturbed if absolutely necessary, and stringent soil stabilization measures would be implemented immediately.

Soils on ridges, sideslopes, and rough broken lands can be subject to accelerated wind and water erosion if disturbed. Additionally, sensitive soils exhibit lower reclamation potential. The actual amount of soil loss and the potential for maintaining long-term productivity depends on site-specific conditions and the effectiveness of proposed mitigation measures.

Moderate construction phase impacts would occur during vegetation stripping, topsoil salvage and temporary stockpiling, cut-and-fill operations, and from increased soil exposure. Soils exposed due to removal of surface cover would be subject to accelerated water and wind erosion until suitable vegetation is restored. Temporary soil compaction could be caused by heavy equipment traffic during the construction phase. Erosion, compaction, and surface crusting due to raindrop impact may result in reduced productivity due to soil loss, damage to

soil structure, decreased infiltration, and decreased water storage capacity.

Impacts to soils would be reduced or minimized through timely and rigorous application of erosion control and reclamation measures. Topsoil salvaged from roadways and WTG construction sites would be spread during the initial reclamation process. The increased depth of topsoil on disturbed areas could potentially enhance reclamation and revegetation efforts on disturbed areas and prevent the loss of topsoil productivity due to long-term storage. These efforts would be monitored and repeated, if necessary, until vegetation is reestablished and erosion is minimized. Soils compacted during construction would be adequately ripped and tilled prior to reseeding. With successful reclamation of exposed areas following construction, implementation of erosion control measures for the LOP, and complete reclamation at the end of the project, impacts to soils would be negligible for the LOP and beyond, except on steep slopes where impacts could be moderate.

Snow accumulation caused by Windplant facilities could have beneficial or adverse effects on soils. Beneficial impact would occur where melting drifts enhance soil moisture, and thereby, increase soil productivity. Moderate adverse LOP impacts would occur if soils on slopes become saturated due to melting drifts and slope movements or piping causes accelerated soil erosion. Potential for these impacts would be evaluated during preparation of the POD for each phase, and appropriate mitigation measures would be implemented.

Table 4.4 presents a comparison of disturbance acreage of sensitive soils for each alternate transmission line ROW. In each case, LOP disturbance (after initial reclamation) would be approximately zero. Alternate 3 would disturb approximately 23 to 31 ac more than Alternates 1 and 2 [assuming a disturbance width of 50.0 ft (15.2 m)]. Alternate 2 would initially disturb 6 ac of soils on steep ridges, sideslopes, and rough broken lands compared with 3 ac along the other two alternates; and therefore, is the least desirable alternate for minimizing erosion and maintaining compliance with the BLM restriction prohibiting construction in areas with slopes greater than 25%. Alternates 1 and 2 would affect 6 and 4 ac of alkaline alluvial soils, respectively, compared with the 1 ac affected by Alternate 3. These soils may be difficult to reclaim, and thus, Alternate 3 would have fewer limitations. However, the assumption that 50.0 ft (15.2 m) would be disturbed along the selected ROW is an overestimate; projected disturbance is only 12.0 ft (3.7 m), and therefore, there is little difference among ROWs in terms of impacts to soils, except for the acreage of soils on steep slopes encountered along Alternate 2.

4.1.6.3 Alternative A

Impacts to soils under Alternative A would be moderate during construction and negligible to moderate for the LOP. However, the total area of soils impacted would be reduced to 1,146 ac initially and 431 ac for the LOP (Table 4.1). Because the transmission line would be built if either the Proposed Action or Alternative A is authorized, impacts to soils from transmission line construction would be the same for Alternative A as for the Proposed Action, and the limitations noted for Alternate 2 due to steep slopes would apply.

4.1.6.4 No Action

Under the No Action Alternative, no impact to soils due to Windplant development would occur.

4.1.6.5 Cumulative Impacts

Total soil disturbance resulting from existing activities plus the proposed action within the KPPA would be approximately 2,226 ac (4% of the KPPA) initially and 1,154 ac (2%) for the LOP. The coal mines contribute substantially to the cumulative impacts to soils; approximately 22,598 ac have been or will be disturbed by the mines. The incremental increase in impacts to soils from the Proposed Action would be 8% of the projected total disturbance created by the coal

Table 4.4 Comparison of Acreage of Disturbance for Each Alternate Transmission Line Route.[1]

Soil Group	Alternate 1	Alternate 2	Alternate 3
Soils on nearly level to moderately steep uplands	147	138	175
Soils on nearly level to gentle slopes on terrace remnants	0	0	0
Soils on ridges, sideslopes, and rough broken lands	3	6	3
Nearly level to gently sloping alkaline alluvial soils	6	4	1
Total	156	148	179

[1] All numbers are in ac, and are based on an initial disturbance width of 50.0 ft (15.2 m).

mines. Approximately 1,344 ac of soils would be disturbed due to the proposed Medicine Bow windfarm; cumulative disturbance from development (i.e., mining, Windplants, existing disturbance) would total 25,096 ac over the LOP. Cumulative LOP impacts would be negligible, since it is assumed that the mines will eventually complete reclamation, and adequate mitigation measures will be implemented as stipulated in the EIS and PODs.

4.1.7 Surface Water and Groundwater

4.1.7.1 Significance Criteria

Impacts to surface water and groundwater would be considered significant if:

- surface water quality declined such that existing WDEQ surface water quality classifications (WDEQ 1990) were no longer applicable (e.g., surface water quality of the Medicine Bow River declined from Class II to Class III or below);
- surface water quantities were depleted such that the water rights of downstream users were violated;
- groundwater quality in local stock or domestic wells declined such that the waters would no longer be suitable for current uses;
- groundwater quantities were depleted such that local wells would no longer serve their present functions;
- project activities were conducted in violation of procedures specified in the approved Stormwater Pollution Prevention Plan (SPPP) (to be provided with the POD for each phase); or
- point source or non-point source impacts to surface water or groundwater violated existing state water quality parameters.

4.1.7.2 Proposed Action

Impacts to surface water quality and quantity from the Proposed Action would be negligible for the LOP and beyond. Potential impacts include increased turbidity, salinity, and sedimentation of surface waters due to runoff and erosion from disturbed areas. Accidental spills of petroleum products or other pollutants also could impact surface water quality (Section 4.7). No surface water would be used for the proposed project, and

thus, no significant impacts resulting from surface water depletions are anticipated.

Erosion control measures, including diversion terraces, riprap, matting, temporary sediment traps, waterbars, and timely revegetation of disturbed areas would minimize runoff-related sedimentation impacts. Erosion-prone areas (e.g., steep slopes, floodplains, and windblown deposits, and the Second and Third Sand Creek special management area) would be avoided, where feasible. If it is necessary to disturb these areas, construction would occur during late summer, fall, or winter, to avoid high flow periods.

Snow redistribution caused by Windplant facilities could affect the local surface hydrology, but impacts are expected to be negligible. Snow accumulation areas would be sources of substantial spring runoff which could cause channel or gully development, ponding, or increased overland flow. Channel or gully formation could result in increased sedimentation of major streams, but the impact is not expected to be significant. Surface runoff patterns also could be affected if facilities prevent or reduce deposition in natural snow accumulation areas. Snow accumulation areas would be monitored and erosion control and/or stream stabilization measures implemented, if necessary, to minimize surface water quality impacts.

Impacts to surface water quality could occur if disturbance within the Second and Third Sand Creek watershed causes accelerated erosion and sedimentation in the Medicine Bow River. During transmission line construction, disturbance within this watershed would be minimized, and stringent erosion control measures would be implemented to prevent accelerated erosion; therefore, impacts would not be significant. Vehicular traffic would be restricted to the ROW. Highly dissected areas (e.g., gullies, headcuts) would be avoided, where feasible. Alternate 3 intersects this watershed below the confluence of Second and Third Sand Creeks, where the creek is deeply incised in a wide alluvial valley. Alternate 2 traverses the middle of this watershed, crossing both Second and Third Sand Creeks, and is thus, the least desirable route for minimizing impacts in this area. Alternate 1 avoids the watershed, and thus, would have no impact on the area.

The southeastern corner of the Simpson Ridge area lies adjacent to Second Sand Creek and its tributaries, and Windplant facilities in this area may impact this watershed. With the use of strict erosion control measures (e.g., avoiding dissected areas, applying erosion control devices such as netting or soil stabilizers, and prompt revegetation of all disturbed areas) impacts would not be significant.

Proper containment of oil and fuel in storage areas and locating facilities away from drainage areas would minimize potential surface water contamination. Contaminated soil from accidental spills would be cleaned up immediately as required by regulation.

Impacts to groundwater would be negligible for the LOP and beyond. Small amounts of surface and or groundwater would be obtained from local municipalities and transported to the site in water trucks for dust abatement purposes. No other groundwater would be used for the proposed project, and thus, impacts to groundwater quantity would be negligible. Groundwater quality could be affected if accidental spills occur in recharge areas, but such spills would be promptly cleaned up, and thus, the potential for polluting groundwater supplies is very slight. Groundwater quality impacts would be negligible for the LOP and beyond.

4.1.7.3 Alternative A

Because the same mitigation measures would be employed under Alternative A as under the Proposed Action, impacts to surface and groundwater would be negligible for the LOP and beyond. The total acreage of new surface disturbance resulting from Alternative A would be reduced from the 1,787 ac required for the Proposed Action to 1,146 ac (Table 4.1), thereby

reducing potential increases in runoff sediment loads.

4.1.7.4 No Action

Under the No Action Alternative, there would be no impact to surface or groundwater from the proposed project.

4.1.7.5 Cumulative Impacts

Since little or no surface water is proposed for use during development of the KPPA, and little or none is being used for other developments in the KPPA, there would be no impact to surface water quantities. Many land uses within the North Platte River basin are causing water quality impairment such that some primary surface water uses are not supported (Gumtow 1994) (Section 3.1.5.1). Within the KPPA, cattle grazing, road maintenance, oil and gas operations, traffic on gravel roads, and off-road vehicle (ORV) use are probably contributing to minor impairment of surface water quality. However, in the Medicine Bow River, the major river bisecting the KPPA, all major surface water uses are supported except the cold water fishery, which is partially supported. Therefore, the cumulative impacts of the multiple land uses occurring within the KPPA are not apparently contributing to significant surface water quality impairment. The proposed Windplant (and the proposed Medicine Bow windfarm) would only minimally, if at all, contribute to water quality impairment (e.g., during road construction wherever streams are crossed, erosion of exposed soils during construction and O&M, road maintenance activities), but these activities are not likely to contribute enough sediments or other pollutants to cause significant cumulative impacts.

The major sources of potential impacts to surface water resources would be increased sedimentation from roads, and possibly, limited amounts of overland flow captured in drainage ditches. Mitigation for the potential discharge of sediment-laden drainage would be the development of a settling/percolation pond for collecting discharged water. Implementation of this mitigation measure would prevent impacts to surface water during the construction of the WTG sites, associated electrical systems, and roadways.

Oil and gas developments within the KPPA produce groundwater as a byproduct of oil and gas production, but there are only 7 active wells within the KPPA; therefore, overall groundwater production is minimal. The Hanna coal mines also have the potential for significantly impacting aquifers for the life-of-mine and beyond. However, the proposed project would not add to groundwater extraction within the KPPA; therefore, no cumulative impact to groundwater quality or quantity is anticipated as a result of the proposed project.

4.1.8 Noise and Odor

4.1.8.1 Significance Criteria

Noise. The Federal Interagency Committee on Noise (FICON) recommends the criteria shown in Table 4.5 for the assessment of noise impacts. These significance criteria are based on the assumption that the probability of an intrusive noise resulting in annoyance is dependent on the existing ambient noise level. The higher the ambient noise level, the smaller the increase in noise level required to generate a significant noise impact. The existing ambient noise levels are such that a project-related noise increase of 5 dBA over ambient levels at sensitive receptors (e.g., local residents, sage grouse leks) would be considered significant.

Odor. Any odors produced by the proposed project would be significant if they caused current land users to vacate the KPPA to avoid exposure to odors.

4.1.8.2 Proposed Action

Noise. Impacts due to increased noise would be negligible for the first phase of development, potentially significant for the 200-MW Foote Creek Rim portion, and negligible for the

Table 4.5 Significance Criteria for Noise Impacts.[1]

Ambient Noise Level Without Project	Significant Impact
<60 dBA	+5.0 dBA or more
60-65 dBA	+3.0 dBA or more
>65 dBA	+1.5 dBA or more

[1] FICON (1992), as applied by Brown-Buntin Associates (1994).

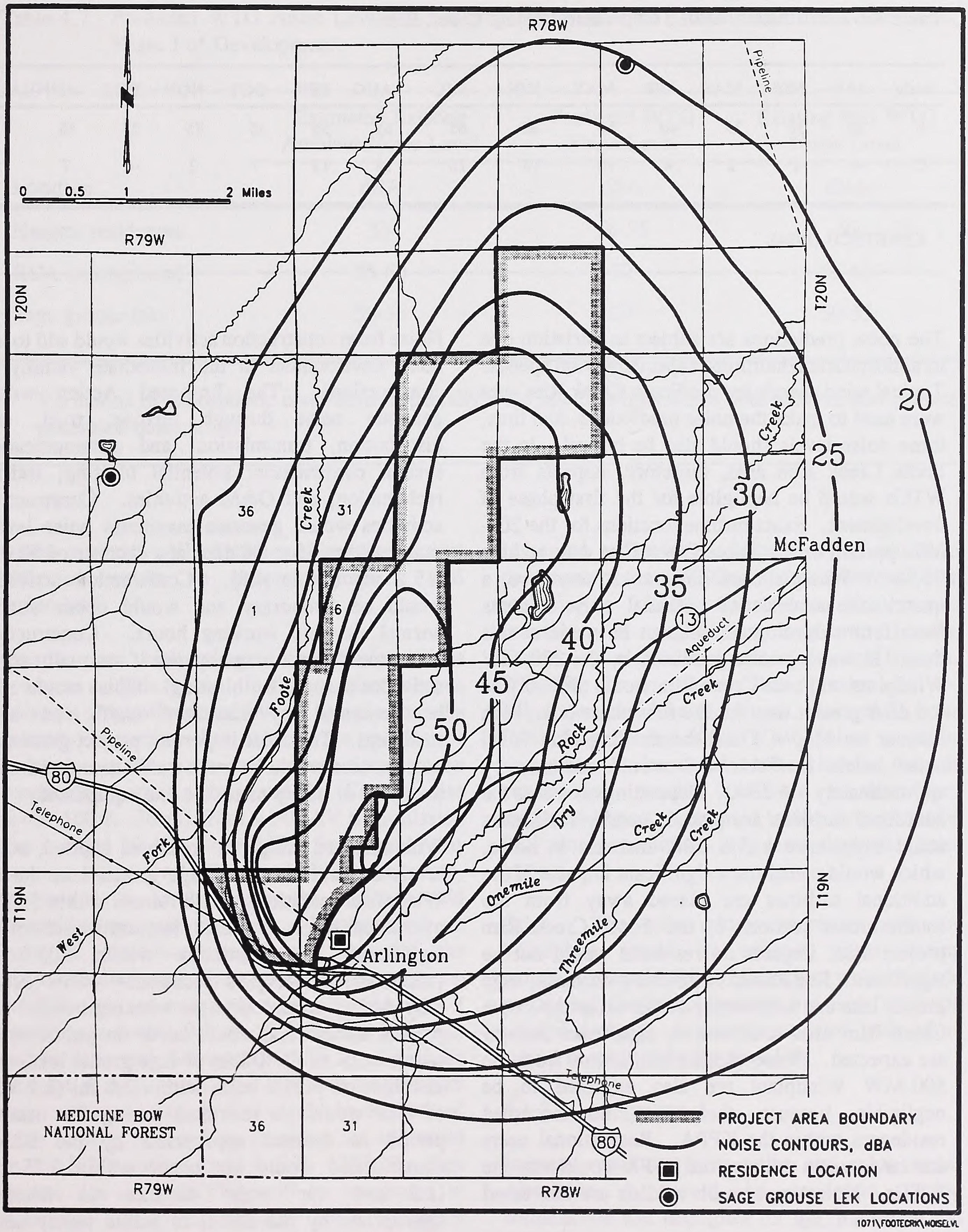
300-MW Simpson Ridge portion of the proposed project. The predominant noise sources associated with the proposed project consist of the WTGs, construction equipment, and the corona effect (the electric discharge at the surface of a conductor or between two conductors) of the high-voltage transmission lines. A combination of noise level measurements, review of existing acoustical literature, and application of accepted noise prediction methodologies was employed to quantify the noise generation of each of these sources.

The Environmental Noise Model (ENM) is a sophisticated noise prediction model capable of generating noise exposure contours of multiple noise sources and various atmospheric and topographic conditions. Data inputs to the ENM include noise source locations, source sound power levels (i.e., dBA), topography, temperature, relative humidity, wind speed and direction, and receiver locations. Each of these variables affects noise levels at receiver locations.

Because atmospheric absorption of sound is generally reduced in cold weather, a temperature of 0 °C was assumed for this analysis to provide a conservative estimate of sound exposure at nearby noise-sensitive locations. From November through March, temperatures average about 0 °C (Table 4.6). A wind speed of 22 mph (10 m/sec) was assumed to represent typical wind speeds on top of Foote Creek Rim. Wind direction is generally out of the west at about 250°. Relative humidity was assumed to average about 35%, which reflects the generally dry conditions in the area. Sensitive receptors identified in the area include the Wyoming Highway Department residences, a KOA campground located near the southern end of Foote Creek Rim, and two sage grouse leks (Map 4.1).

Noise emissions from the 33M-VS turbine have been measured by KENETECH using the American Wind Energy Association *Procedure of Measurement of Acoustic Emissions from Wind Turbine Generator Systems* (1989). Noise levels at the base of a single 33M-VS WTG average 99.3 dBA. A total of 204 WTGs were included in the analysis (three more than would be erected for the first phase of development). Noise impacts from the full 500-MW Windplant are discussed below.

Map 4.2 and Table 4.7 present the predicted noise levels generated by the first phase of development on the Foote Creek Rim area and show that there would be little to no increase in ambient noise levels for the sensitive receptors analyzed. Ambient noise levels at the nearest residences average 59 dBA; predicted levels after project development would average 60 dBA. At the nearby sage grouse lek locations, existing ambient levels and predicted post-development levels are identical (50 to 55 dBA).



Map 4.2 Predicted Noise Levels at Existing Noise-sensitive Areas, Foote Creek Rim Area.

Table 4.6 Estimated Mean Temperature, Foote Creek Rim.

Scale	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F	25	30	35	40	50	60	65	65	55	45	35	25	45
°C	-4	-1	2	4	10	16	18	18	13	7	2	-4	7

[1] KENETECH (1994).

The noise predictions are subject to variation due to atmospheric conditions, especially wind speeds. Typical wind speeds for the Foote Creek Rim area were used to make the noise predictions, and thus, these noise levels should also be typical. In the Foote Creek Rim area, therefore, impacts from WTGs would be negligible for the first phase of development. Exact turbine locations for the 200-MW portion on the Foote Creek Rim area and the 500-MW Windplant are not known; therefore, a quantitative analysis of potential noise impacts from future development cannot be made at this time. However, noise produced by the 200-MW Windplant on Foote Creek Rim would probably be 4.6 dBA greater than for the first phase (i.e., each contour on Map 4.1 and the existing plus WTG noise levels in Table 4.7 would increase by approximately 4.6 dBA). Depending on where the additional turbines are placed, nearby residences could experience a 5.6 dBA increase in noise, which would constitute a significant impact. If the additional turbines are placed away from the southernmost sections of the Foote Creek Rim project area, impacts on residents would not be significant. Regardless of turbine placement, sage grouse leks are sufficiently distant from the Foote Creek Rim area such that no significant impacts are expected. Noise impacts on humans from the 500-MW Windplant are also expected to be negligible because there are no occupied residences within the KPPA. Recreational users and landowners utilizing the KPPA would hear the WTGs. Noise impacts on wildlife are addressed in Section 4.2.3.

Noise from construction activities would add to the noise environment in the immediate vicinity of construction. The Proposed Action would generate noise through turbine, road, and distribution, transmission, and communication system construction; potential blasting; traffic; reclamation; and O&M activities. Construction activities would generate maximum noise levels ranging from 85 to 88 dBA at a distance of 50.0 ft (15.2 m) (Table 4.8). Construction activities would be temporary and would occur during normal daytime working hours. Construction noise could result in annoyance if unusually noisy activities occur (i.e., blasting). Noise would also be generated by increased traffic on area roadways. The most important project-generated noise source would be truck traffic associated with transport of heavy materials and equipment.

With standard mitigation measures applied, noise levels at residences and sage grouse leks during Windplant operations would remain within 5 dBA of ambient levels, and thus, impacts would not be significant. Construction within 500.0 ft (152.4 m) of occupied residences would occur only during normal daytime working hours. No surface disturbance would occur on public lands within 0.25 mi (0.40 km) of sage grouse leks, and activities on public lands within 2.0 mi (3.2 km) of leks would be restricted during the nesting period as deemed appropriate by the BLM. Construction would not occur within 0.75 mi (1.21 km) (or other distance as deemed appropriate by the BLM) to active raptor nests during nesting periods or within 0.75 mi (1.21 km) of crucial winter range during critical

Table 4.7 Predicted WTG Noise Levels at Existing Noise-sensitive Areas, Foote Creek Rim Area, Phase I of Development.

Location	Estimated Existing Ambient Noise Level dBA	Predicted WTG Noise Level dBA	Existing Plus WTG Noise Level dBA
Nearest residences	59	50-55	60
KOA campground	55-60	52	55-60
Sage grouse leks	50-55	27	50-55

[1] Variations in atmospheric conditions, especially wind speed, would affect both ambient and project-generated noise levels.

winter periods. All engines required for project activities would be properly muffled and maintained.

Corona on high-voltage transmission lines produces audible noise. In fair weather, corona noise is typically inaudible to people on the ground. In wet weather, when large numbers of corona sources form as water droplets on conductors, corona noise is audible. Corona noise levels 100 ft (30 m) from a 500-kV transmission line average 20 dBA and 45 dBA in dry and rainy weather, respectively (Lee et al. 1989); therefore, ambient noise levels within the KPPA would generally mask corona noise. Furthermore, no occupied residences occur near any of the proposed alternates. Impacts of corona noise on wildlife are not currently known; Alternate 3 would pass within 0.5 mi (0.8 km) of four sage grouse leks and Alternates 1 and 2 would pass within 0.5 mi (0.8 km) of 5 leks, but the potential noise effects on sage grouse cannot be determined from existing data and are therefore not addressed in this EIS pursuant to 40 C.F.R. 1502.22. Sage grouse use of the KPPA will be monitored to determine possible impacts of Windplant construction and operation on use.

Increased noise levels from the first phase of development (i.e., WTGs and associated facilities, including a 230-kV transmission line) would constitute a negligible, long-term impact. Depending on turbine placement, impacts from the 200-MW Foote Creek Rim portion of the Windplant could be significant. Increased noise levels from the full 500-MW Windplant would be negligible. Increased noise levels due to construction would constitute a short-term, moderate impact. Increased traffic throughout the LOP would constitute a long-term, negligible noise impact.

Odor. The only odors associated with the Windplant would be exhaust odors during construction and O&M. Mitigations would include proper equipment maintenance and use of emission control devices. Impacts associated with odors would be negligible for the LOP.

4.1.8.3 Alternative A

Impacts resulting from noise and odor under Alterative A would be moderate during construction and negligible for the first phase and 300-MW Simpson Ridge portion. Because fewer turbines would be erected, it may be possible to

Table 4.8 Typical Construction Equipment Noise.

Type of Equipment	Maximum Level, dBA at 50.0 ft (15.2 m)
Bulldozer	87
Heavy truck	88
Backhoe	85
Pneumatic tool	85

Cunniff (1977).

locate further development on the Foote Creek Rim area away from nearby residences, thereby avoiding a potentially significant impact. Noise and odor impacts would be reduced by approximately 40%, since fewer WTGs would be erected and commissioned. Noise and odor impact mitigations identified for the Proposed Action would be implemented under Alternative A, and thus, impacts would be moderate during construction and negligible for the LOP.

4.1.8.4 No Action

No additional impact from noise and odor above existing levels on the KPPA would occur under the No Action Alternative.

4.1.8.5 Cumulative Impacts

Noise. Existing land uses within the KPPA (e.g., livestock grazing, oil and gas production, transportation, recreation) contribute to noise levels, but wind is generally the primary noise source. The proposed project would increase the number of noise-producing facilities within the KPPA, which may augment the level of impacts to other resources (e.g., increased acreage of wildlife habitat loss, increased impacts to recreational users) (see Sections 4.2.3 and 4.5.2.5). The addition of the proposed Medicine Bow windfarm would further contribute to increased noise levels. Large turbines (i.e., 500-2000 kW) are proposed for the Medicine Bow project, but exact models have not been identified, and thus, expected noise levels are unknown. If noise is a factor that contributes to big game or avian displacement, cumulative impacts could be significant (Section 4.2.3). Because turbine noise is typically masked by the wind at short distances from WTGs and because there are few occupied residences within or adjacent to the KPPA, cumulative impacts would probably be negligible for the LOP. Sage grouse use within the KPPA would be monitored, and additional mitigations would be developed if changes in sage grouse use patterns are attributed to the Windplant.

Odor. Most odors in the KPPA would be associated with Windplant construction equipment and would be short-term. Odors from O&M vehicles would be negligible for the LOP; therefore, cumulative impacts from odors would be negligible.

4.1.9 Electric and Magnetic Fields

4.1.9.1 Significance Criteria

Significant impacts from EMFs would occur if transmission line operation resulted in direct adverse health effects on humans residing in or using the KPPA. Significant effects on radio and

TV frequencies would occur if Windplant operation resulted in the interruption of permitted TV or radio transmissions.

4.1.9.2 Proposed Action and Alternative A

Because EMF levels generated by the 230-kV transmission line are low, impacts would be negligible for the LOP and beyond for the Proposed Action and Alternative A. Future residential development may be limited due to the transmission line, but this potential impact would be negligible because the area is rural and alternate building sites are numerous.

Turbines with metal rotors are known to interfere with radio and TV transmissions; however, the 33M-VS uses only fiberglass rotors, and thus, no impacts on EMFs would occur under the Proposed Action or Alternative A.

4.1.9.3 No Action and Cumulative Impacts

Under the No Action Alternative, no impacts to/from EMFs would occur. There are only two small segments of other transmission lines within the KPPA, and the proposed Medicine Bow windfarm would probably be connected to an existing WESTERN transmission line. Cumulative impacts to/from EMFs would be negligible for the LOP and beyond.

4.2 BIOLOGICAL RESOURCES

4.2.1 Vegetation

4.2.1.1 Significance Criteria

Impacts to vegetation resulting from the proposed project would be considered significant if:

- an overall change in land use occurs due to changes in vegetation;
- vegetation productivity is not restored to at least predisturbance levels within five years after reclamation;
- species composition or diversity change by greater than 20%, due to unsuccessful reclamation of disturbed areas or snow redistribution; and/or
- uncontrolled weed invasion of project area or adjacent areas occurs.

These criteria do not have a regulatory or scientific precedence, but have been used in recent EISs (BLM 1994d) by the GDRA and the Rawlins District Office.

4.2.1.2 Proposed Action

Impacts to vegetation would be potentially significant to negligible for the LOP and beyond. Potentially significant impacts would occur due to localized changes in plant community species composition due to changes in snow deposition patterns caused by Windplant facilities. Vegetation removal, temporary changes in vegetation types (e.g., shrubland to grassland conversions during reclamation), weed infestations, and the potential for accelerated erosion constitute both short-term and LOP impacts. Mitigation measures to limit vegetation impacts include minimizing the extent of disturbance, using appropriate erosion and sedimentation controls, using weed control practices as deemed appropriate by the BLM, and implementing prompt revegetation using an appropriate locally adapted seed mixture. With the application of these mitigation measures, impacts to vegetation resulting from the Proposed Action due to disturbance are anticipated to be negligible for the LOP unless reclamation is unsuccessful after five years. Because only 3% of the KPPA would be disturbed by Windplant development, impacts to vegetation would not create an overall land use change (Section 4.5).

The acreage of vegetation types that would be disturbed by Phase I of the project was determined from the facilities location map (Map 2.1). The Phase I, 70.5-MW development would affect 319 ac (Table 4.9). Grassland and meadow/riparian vegetation community types would be most heavily impacted, with 14% (2 ac) and 13% (4 ac) of the total acreage of these types in the KPPA being disturbed, respectively (see Section 4.2.2 for a

Table 4.9 Vegetation Disturbance Acreage, Phase I and the 500-MW Windplant.

Type	Phase I 70.5 MW				Full Windplant 500 MW[1]			
	New	% of Type[2]	LOP	% of Type[2]	New	% of Type[2]	LOP	% of Type[2]
Mixed grass/sagebrush shrubland	45	1	16	<1	188	6	82	3
Cushion plant/grassland	105	8	49	4	168	13	76	6
Mountain shrubland	4	<1	0	0	195	3	84	1
Aspen woodland	0	0	0	0	7	5	3	2
Ponderosa pine woodland	0	0	0	0	1	4	1	4
Meadow/riparian areas	4	13	1	3	6	19	2	6
Grassland	2	14	2	14	4	29	2	14
Sagebrush shrubland	147	<1	0	0	1034	3	389	1
Saltbush shrubland	6	<1	0	0	79	2	33	1
Barren or near-barren areas	4	<1	0	0	65	2	27	1
Greasewood shrubland	2	<1	0	0	40	3	16	1
Total	319	--	68	--	1,787	--	715	--

[1] Because the exact locations of future phases are unknown, vegetation disturbance for the full 500-MW Windplant was assumed to be proportional to the acreage of types currently existing in the Foote Creek Rim and Simpson Ridge areas plus the Alternate 3 ROW (see text).

[2] Percentage of type is based on total acreage of each type in the Foote Creek Rim and Simpson Ridge areas plus the Alternate 3 ROW as given in Table 3.9.

discussion of wetlands impacts). Approximately 147 ac of sagebrush shrubland and 105 ac of cushion plant/grassland types would be disturbed, which amounts to <1% and 8% of the total acreage of these types within the KPPA.

Because the exact locations of disturbance for phases subsequent to Phase I are unknown, vegetation disturbance for these areas was estimated by multiplying the proportions of vegetation types in the Foote Creek Rim and Simpson Ridge areas, respectively (Table 3.9), by the expected LOP disturbance (1,787 ac). These estimates were added to disturbance acreages (by vegetation type) for Phase I. Of the 1,787 ac of initial disturbance for the 500-MW Windplant, most disturbance would occur in sagebrush shrubland (1,034 ac). However, this represents only 3% of the total acreage occupied by this type. Grasslands (29%) would be most affected. Meadow/riparian vegetation community types also could be substantially affected (19% of the total acreage for this type within the KPPA), but these areas would be avoided, where feasible. Total LOP disturbance would impact 389 ac (1%) of sagebrush shrubland and 1 to 84 ac (1-14%) of other vegetation types.

Redistribution of snow caused by the Windplant could alter vegetation patterns within the KPPA. Spring snowmelt in snow accumulation areas would increase the effective precipitation in soils, which would favor plant species that require more mesic habitats. Conversely, a reduction in drifting in natural snow accumulation areas would shift species composition towards species favoring xeric habitats. Shifts in species composition may be significant in localized areas, but the overall mosaic within the KPPA probably would not change by greater than 50% because of the overriding influence of climate and soils on plant communities; therefore, areawide impacts are not expected to be significant.

Areas scheduled for reclamation would be seeded with a BLM-approved mixture of plant species in the fall prior to ground freeze-up, or in the spring prior to April 15 if fall seeding is not feasible. Reclamation procedures would comply with the BLM's *Wyoming Policy on Reclamation* (BLM 1990b). Potential plant species for use in reclamation are discussed in Section 5.1.3.10. Appropriate erosion control techniques (e.g., waterbars, mulch, etc.) would be employed as needed.

Revegetation may, during some years or at some locations, be inhibited by droughts and/or soil limitations. Windplant owners and/or KENETECH personnel, under BLM supervision, would be responsible for monitoring reclamation success. In addition, site-specific conditions at each proposed development site would be evaluated during the POD preparation, and appropriate measures such as ripping, pitting, windrowing, mulching, and/or reseeding with BLM-approved alternative non-native species would be employed. Increases in abundance of weedy species would be mitigated promptly using BLM-, county-, and landowner-approved control methods. The primary procedure for preventing weed infestation would be prompt revegetation of disturbed areas with locally adapted desirable plant species. If weed control is necessary, mechanical means (e.g., harrowing, discing) may be used. If chemical control is necessary, prior approval would be obtained from the BLM, the county, or landowners, and only chemicals approved for the specific application would be used.

<u>4.2.1.3 Alternative A</u>

Under Alternative A, approximately 40% less vegetation would be disturbed than under the Proposed Action (1,146 ac initially and 431 ac for the LOP) (Table 4.1). Because mitigation and reclamation measures would be implemented as described for the Proposed Action, these disturbance-caused impacts to vegetation would be negligible for the LOP. Impacts to vegetation patterns due to snow redistribution also would be reduced by approximately 40%, but the impact would be potentially significant due to localized changes in plant species composition.

4.2.1.4 No Action

No increased impacts beyond existing levels would occur to vegetation under the No Action Alternative, since no additional disturbance would occur.

4.2.1.5 Cumulative Impacts

Existing and proposed disturbance in the KPPA would total 2,226 ac (4% of the KPPA) initially and 1,154 ac (2%) for the LOP (Table 4.1). The coal mines also contribute to substantial vegetation disturbance in the region (22,598 ac total or approximately 5,741 ac in any one year). The proposed Medicine Bow windfarm would disturb an additional 1,344 ac. The primary measures for reducing cumulative impacts would be successful revegetation with adapted, native and introduced plant species and avoidance of meadow/riparian areas, where feasible. It is assumed that successful revegetation would be accomplished, and therefore, post-development land use, productivity, plant species diversity, ground cover, wildlife habitat, and weed control goals would be achieved, and long-term cumulative impacts would be negligible. However, there would be an overall shift in the character of vegetation from shrublands to grasslands because of the time needed to establish shrubs in this low precipitation environment (15 to 20 years), and this would be considered a moderate long-term impact.

4.2.2 Wetlands and Riparian Areas

4.2.2.1 Significance Criteria

Impacts to wetlands and riparian areas would be considered significant if project activities resulted in violation of Section 404 of the Clean Water Act or Executive Order 11990. Section 404 governs the placement of dredged or fill material in waters of the U.S., and Executive Order 11990 mandates no net loss of wetlands.

4.2.2.2 Proposed Action

Where feasible, no surface disturbance would occur within 500 ft (152 m) of wetlands or open water, or within 100 ft (31 m) of ephemeral or intermittent channels; and since there would be no net loss of wetlands, impacts to wetlands would be negligible. Wetlands and riparian areas that rely on snow accumulation to preserve wetland and riparian characteristics would be impacted if Windplant facilities reduce or prevent snow accumulation in these areas. In snow deposition areas, wetlands or riparian areas may be enhanced by the Windplant. Potential effects of snow redistribution on wetlands and riparian areas would be evaluated during POD preparation and the Section 404 permitting process. Impacts to wetlands and riparian areas would be mitigated by locating facilities to avoid impacting these areas and/or through other measures specified in the SPPP.

There are no wetlands on top of Foote Creek Rim that would be impacted by Phase I of the proposed project. The primary access road, however, would cross areas potentially containing wetlands. Formal wetland delineations of these areas would be conducted during the spring of 1995, and all permits necessary to comply with the above-referenced laws would be obtained prior to road construction.

Best management practices would be used during construction in all wetland/riparian areas, including, but not limited to: construction during periods of low or no water; following existing ROWs and using existing crossings; and creating temporary diversions using temporary channel stabilization techniques (e.g., riprap), where feasible.

If disturbance to wetland or riparian areas is unavoidable, appropriate mitigation measures would be developed in coordination with the COE and BLM biologists. If rehabilitation of a wetland area is required, the initial primary objective would be soil stabilization with native species. The desired plant species composition after

rehabilitation would depend on site-specific objectives.

4.2.2.3 Alternative A

Since there would be no net loss of wetlands and project activities would comply with Section 404 of the Clean Water Act, impacts to wetlands and riparian areas under Alternative A would be negligible.

4.2.2.4 No Action

There would be no impacts to wetlands or riparian areas from the proposed project under the No Action Alternative, since no further development of the KPPA would occur.

4.2.2.5 Cumulative Impacts

Cumulative impacts to wetlands and riparian areas would be negligible because most past and all present and future development activities would comply with Section 404 of the Clean Water Act and Executive Order 11990. Effects of snow distribution on wetlands would be monitored, if required by the BLM or the COE during the Section 404 permitting process, and mitigations would be developed for any wetlands lost, if necessary. The coal mines are typically required by WDEQ to replace wetlands and riparian areas at least ac-for-ac and in kind. Avoidance and mitigation measures would be applied to all present and future developments.

4.2.3 Wildlife and Fisheries

Information pertaining to the impact of large-scale Windplants on wildlife is limited; some research has been done pertaining to collision mortality and raptors in California (see Section 4.2.3.4 for details). The direct impact of habitat loss resulting from construction of the Windplant and associated ancillary facilities is quantifiable, and the significance of this loss to various wildlife resources within the KPPA can be estimated. On the other hand, to quantify the effects of such influences as noise, visual disturbance, human activity, and changes in snow distribution on wildlife behavior and habitat use is difficult. An extensive search of the literature pertaining to impacts on wildlife resources from oil and gas development, surface mining, roads, fences, human activity and other sources of disturbance provided the means to describe a range of potential effects to wildlife due to the proposed Windplant.

4.2.3.1 Big Game

Significance Criteria. For this EIS, impacts to big game would be considered significant if project-related activities resulted in a loss of greater than 1% of the existing crucial big game range for a particular herd unit (Environmental Research and Technology, Inc. 1983a, 1983b). The rationale for this criterion is provided below.

There is a lack of definitive research regarding the level of disturbance within big game crucial habitat (i.e., crucial range) that constitutes a significant impact to big game populations. As a result, regulatory agencies operate under slightly different guidelines pertaining to the amount and type of disturbance allowed within big game crucial range. In the opinion of the WGFD, all crucial big game habitat is vital to sustain communities, populations, or subpopulations of big game animals (WGFD 1994c). As part of their mitigation policy, the WGFD is directed by the Wyoming Game and Fish Commission "to *recommend* no loss of habitat function within crucial habitat" (WGFD 1994c). Habitat function is defined as "the arrangement of habitat features, and the capability of those features, to sustain species, populations, and diversity of wildlife over time" (WGFD 1994c). Although some modification of habitat characteristics may occur due to proposed developments, the habitat function of crucial range must be maintained (i.e., the location, essential features, and species supported must remain unchanged).

The amount of crucial habitat removed within a given herd unit by development activities is a quantifiable measurement of impacts to habitat function. The BLM has determined that project-

related disturbance of up to 1% of the crucial range of a big game herd unit is unlikely to significantly impact the habitat function of such range, and has incorporated this standard into recent EISs for proposed projects within Wyoming (BLM 1992a, 1994d). Displacement of big game from areas adjacent to the Windplant and associated facilities due to visual and noise characteristics of the proposed project may also impact habitat function; the potential extent of this impact, based on published research, is described below on a species-specific basis. The response of big game populations to Windplant presence and operation will be monitored beginning with Phase I construction to determine the extent of disturbance to these populations, and to assess the potential impacts to big game associated with the construction and operation of the 500-MW Windplant. If it is determined from this initial monitoring that the proposed project would present a potentially significant impact to big game, BLM would initiate site-specific, detailed analyses for the affected species to definitely evaluate impacts.

Proposed Action. All four big game species commonly occurring within the KPPA (i.e., pronghorn, mule deer, white-tailed deer, and elk), would experience, at a minimum, some disturbance due to habitat loss and displacement from construction and O&M activities of the proposed Phase I and 500-MW Windplant. The acreages presented below are for the amount of habitat actually disturbed; additional habitat adjacent to the actual disturbance may not be used by big game due to the presence of humans and equipment during construction and O&M activities.

Impacts to pronghorn habitat due to Phase I activities would be negligible during construction and throughout the LOP. Approximately 54 ac of pronghorn crucial winter/yearlong range would be disturbed within the Medicine Bow Herd Unit due to Phase I construction; this represents 0.02% of this range type within the herd unit (Table 4.10). Since all of this disturbance within crucial range is the result of the construction of the 230-kV transmission line, virtually no disturbance would remain once the area around the poles is fully reclaimed (i.e., LOP). The only other pronghorn range type that would be disturbed by construction and operation of Phase I is winter/yearlong range. Approximately 265 ac of this range would be initially disturbed by Phase I activities; this represents a negligible loss of about 0.04% of this range within the Medicine Bow Herd Unit. The disturbed area would decrease to 68 ac (0.01%) following reclamation (i.e., LOP).

Initial pronghorn habitat loss due to construction of the 500-MW Windplant would result in a moderate impact to the Medicine Bow Herd, and this impact would likely remain moderate for the LOP. Construction of the 500-MW Windplant would result in an initial loss of 140 ac of crucial winter/yearlong range for the Medicine Bow Pronghorn Herd, or 0.06% of this range type within the herd unit (Table 4.10). This is a small percentage of available crucial habitat and well below the significance criterion of 1% loss of crucial habitat stated above. Some habitat loss within pronghorn crucial range (i.e., 38 ac, or 0.02%) would remain during the LOP; loss could be reduced to zero if WTGs are located outside of this range type. The greatest habitat loss for pronghorn would be within winter/yearlong range: 1,262 ac would be disturbed initially (i.e., 0.21% of this range type within the herd unit), and 509 ac (0.08%) would remain unavailable for pronghorn use for LOP. This winter/yearlong habitat loss would likely be a moderate impact to the herd. Some acreage would also be lost within spring-summer-fall range [i.e., 385 ac (0.14%) initially and 168 ac (0.06%) LOP].

The overall response of pronghorn to the fully operating 500-MW Windplant is difficult to predict. Yeo et al. (1984), studied pronghorn response to two large WTGs immediately north of the KPPA and determined that pronghorn were not displaced from their home ranges due to the presence of the WTGs. Pronghorn also quickly adapted to the increase in traffic associated with the construction and operation of the WTGs, although roads did influence the distribution of pronghorn during the hunting season. Yeo et al.

Table 4.10 Potential Initial and LOP Disturbances Within Regional Wildlife Habitats for Proposed Action and Alternative A.

Wildlife Resource	Acreage of Wildlife Habitat Within the Region	Proposed Action								Alternative A			
		70.5 MW Phase I				500-MW Windplant				300-MW Windplant			
		Acreage of Disturbance Within Wildlife Habitat		Percentage of Wildlife Habitat Disturbed		Acreage of Disturbance Within Wildlife Habitat		Percentage of Wildlife Habitat Disturbed		Acreage of Disturbance Within Wildlife Habitat		Percentage of Wildlife Habitat Disturbed	
		New[1]	LOP[2]	New[3]	LOP[4]	New[1]	LOP[2]	New[3]	LOP[4]	New[1]	LOP[2]	New[3]	LOP[4]
Pronghorn antelope													
Medicine Bow Herd													
Crucial winter/yearlong range	227,584[5]	54	0	<0.1	0	140	38	<0.1	<0.1	106	23	<0.1	<0.1
Spring-summer-fall range	278,976[6]	0	0	0	0	385	168	0.1	<0.1	232	101	<0.1	<0.1
Winter/yearlong range	605,760[7]	265	68	<0.1	<0.1	1,262	509	0.2	<0.1	808	307	0.1	<0.1
Mule deer													
Platte Valley Herd													
Winter/yearlong range	754,368[7]	0	0	0	0	164	72	<0.1	<0.1	99	44	<0.1	<0.1
Yearlong range	203,136[8]	0	0	0	0	234	102	0.1	<0.1	141	62	<0.1	<0.1
Sheep Mountain Herd													
Crucial winter/yearlong range	158,080[5]	42	0	<0.1	0	42	0	<0.1	0	42	0	<0.1	0
Winter/yearlong range	696,960[7]	275	68	<0.1	<0.1	1,345	541	0.2	<0.1	862	325	0.1	<0.1
Shirley Mountain Herd													
Yearlong range	459,840[8]	2	0	<0.1	0	2	0	<0.1	0	2	0	<0.1	0
White-tailed deer													
Laramie River Herd													
Winter/yearlong range	161,856[7]	4	2	<0.1	<0.1	11	5	<0.1	<0.1	7	3	<0.1	<0.1
Yearlong range	481,984[8]	15	0	<0.1	0	15	0	<0.1	0	15	0	<0.1	0
Elk													
Snowy Range Herd													
Winter/yearlong range	219,520[7]	318	68	0.1	<0.1	1,365	531	0.6	0.2	890	319	0.4	0.1
Sage Grouse													
Probable nesting habitat	300,000[9]	110	2	<0.1	<0.1	1,185	471	0.4	0.2	754	282	0.3	0.1
Potential breeding habitat[10]	9,425[9]	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.10 (Continued)

[1] New disturbance acreages are based on percentages of totals from Table 2.1(a); multiply number of ac by 0.4047 to compute number of hectares.
[2] LOP disturbance acreages are based on percentages of totals from Table 2.1(a).

[3] Percentage of new disturbance = $\frac{\text{total new disturbance within wildlife habitat}}{\text{total acreage of wildlife habitat within the region}} \times 100$

[4] Percentage of LOP disturbance = $\frac{\text{total LOP disturbance within wildlife habitat}}{\text{total acreage of wildlife habitat within the region}} \times 100$

[5] Total acreage of crucial winter/yearlong range for herd (WGFD 1994a).
[6] Total acreage of spring-summer-fall range for herd (WGFD 1994a).
[7] Total acreage of winter/yearlong range for herd (WGFD 1994a).
[8] Total acreage of yearlong range for herd (WGFD 1994a).
[9] Adapted from Medicine Bow-Divide Resource Area RMP data (BLM 1987:200) for the Shirley Mountain Habitat Management Plan (HMP) area and the proposed Saratoga Valley HMP area.
[10] Potential sage grouse breeding habitat would be avoided.

(1984) also noted that the proliferation of access roads associated with the WTG development promoted increased harvest.

Pronghorn have exhibited a variety of responses to disturbance related to other types of energy development. In central Wyoming, pronghorn tended to avoid oil fields in which drilling and well maintenance activities occurred (Easterly et al., n.d.). Some animals, however, habituated to human activity associated with petroleum exploration and production, and remained near oil fields during and after drilling operations. A portion of a pronghorn population in the Red Desert of Wyoming habituated to activities associated with a uranium mining project and were observed to migrate around, under, and over man-made structures used in mining operations (Deblinger 1988). Pronghorn does and fawns were commonly observed near the mine pit; they were also observed near oil and gas wells and roads in the area. Other individuals avoided the mine site and migrated around the area without difficulty. Segerstrom (1982) noted that pronghorn near an operational coal mine in Montana habituated to many types of human activity associated with the mining operation; pronghorn generally responded to disturbing situations by slowly moving away from the source of disturbance. The mean intensity of pronghorn reactions to human activity on the mine site was significantly less than the intensity of reactions on a control site.

It is likely that some proportion of pronghorn within the Medicine Bow Herd will habituate to the presence of operating WTGs, as well as to the increased traffic associated with WTG maintenance. Reeve (1984) observed that pronghorn at the large WTG north of the KPPA habituated to construction traffic (i.e., 100+ vehicles/24 hrs) and did not abandon the site. Easterly et al. (n.d.) also noted that pronghorn within sight of an access road did not run in response to traffic going to and from the well pad unless vehicles moved slowly or stopped. To avoid disturbing pronghorn adjacent to Windplant roads, KENETECH personnel would be instructed not to stop their vehicles between service stops unless absolutely necessary. Some pronghorn probably would not habituate to the presence of the Windplant and its associated activities. These animals would likely stay some distance from WTG strings and access roads; it is unknown if this displacement would adversely effect the behavior and fitness of these pronghorn. Monitoring of pronghorn populations, as well as those of other big game species, during Phase I construction and operation will provide insight into the responses and level of habituation of big game to Windplant presence and O&M activities.

Overall, impacts to pronghorn within the KPPA resulting from the construction of the Windplant would range from negligible (Phase I) to moderate (500-MW Windplant); these impacts would remain negligible (Phase I) to moderate (500-MW Windplant) for the LOP. Based on the pronghorn studies discussed above, it is likely that a portion of the pronghorn population within the KPPA will habituate to the operating Windplant and associated O&M activities and will continue to use habitat adjacent to WTGs. Impacts to pronghorn from the noise and movement associated with WTGs, as well as increased human presence, will probably be moderate throughout the LOP (i.e., will not adversely effect population health).

Impacts to mule deer herds within the KPPA would be negligible during construction and operation of Phase I. Only the Sheep Mountain Herd would experience more than 2 ac of habitat loss due to Phase I construction activities (Table 4.10). Forty-two ac of crucial winter/yearlong range would be initially disturbed during Phase I, which represents approximately 0.03% of this habitat type within the Sheep Mountain Herd Unit (i.e., a negligible impact). With successful reclamation, disturbance within mule deer crucial habitat would decrease to zero for the LOP. Habitat loss within other range types for the Sheep Mountain Herd would be negligible for Phase I. Approximately 275 ac of winter/yearlong range within the Sheep Mountain Herd would be disturbed during Phase I construction (i.e., 0.04% of this range within the

herd unit), but this would decrease to 68 ac (0.01%) during the LOP. Mule deer habitat loss within the Shirley Mountain Herd would be negligible; 2 ac within yearlong range would initially be disturbed. No mule deer habitat would be lost within the Platte Valley Herd due to Phase I construction or operation.

Mule deer crucial winter/yearlong range loss due to 500-MW Windplant construction and operation would remain at the same level of significance as that due to Phase I (i.e., a negligible impact) (Table 4.10); the same transmission line is required for both situations, and this is the only location where mule deer crucial range occurs within the KPPA. The greatest loss of mule deer habitat due to construction of the 500-MW Windplant would occur within Sheep Mountain winter/yearlong range, with an initial disturbance of 1,345 ac (0.19% of this range type for the herd unit); this represents a moderate impact to the herd. Five hundred forty-one ac (0.08%) would remain unavailable to mule deer within this range type for the LOP. Potential impacts within the Platte Valley Mule Deer Herd would range from negligible to moderate; 234 ac of yearlong range (i.e., 0.12% of this range type within the herd unit) and 164 ac (i.e., 0.02%) of winter/yearlong range would initially be disturbed by the full project. Habitat disturbance in the Shirley Mountain Herd would remain negligible under the 500-MW Windplant (i.e., 2 ac of initial disturbance).

It is possible that mule deer within the KPPA will adapt to Windplant presence and operation. Mule deer frequented areas in and near oil fields in central Wyoming, and appeared to be less sensitive to human-caused disturbances than pronghorn (Easterly et al. n.d.). Irby et al. (1988) noted that low-level oil and gas development in western Montana had little effect on wintering mule deer; high-intensity exploration and production activity, however, could impact populations by making wintering areas unsuitable for mule deer. Mule deer continued to occupy areas immediately adjacent to an operating coal mine in Wyoming (Reed 1981). Mule deer also apparently habituate to the auditory and visual stimuli associated with access roads, and have been observed using areas adjacent to these roads (Reed 1981, Easterly et al. n.d.). Monitoring of mule deer response to WTG presence and activity during Phase I will help determine if mule deer habituate to Windplant development.

In summary, impacts to mule deer within the KPPA from construction of the proposed Windplant would range from negligible (Phase I) to moderate (500-MW Windplant); these impacts would remain negligible (Phase I) or moderate (500-MW Windplant) for the LOP. Mule deer will probably habituate, at least to some extent, to the noise and activity associated with the operating Windplant, and will likely continue to use habitat adjacent to WTGs. Unless Phase I monitoring of mule deer populations reveals otherwise, it is anticipated that impacts to mule deer from the 500-MW Windplant O&M activities will be moderate throughout the LOP.

The Laramie River Herd of white-tailed deer would experience minimal habitat loss due to Phase I and 500-MW Windplant activities (Table 4.10). Fifteen ac (<0.01%) of yearlong range would initially be disturbed by construction of the 230-kV transmission line, but this disturbance would virtually disappear for the LOP. Four ac (<0.01%) of winter/yearlong white-tailed deer range would be potentially disturbed by Phase I construction of the Windplant; current proposed placement of the turbine strings on the Foote Creek Rim area would reduce this habitat disturbance to zero. Slightly more winter/yearlong range may be disturbed due to construction of the 500-MW Windplant [i.e., 11 ac (<0.01%) initially and 5 ac (<0.01%) LOP]. Disturbance within yearlong range as a result of construction of the 500-MW Windplant would remain the same as that for Phase I; there would be no new disturbance for the 500-MW Windplant if the transmission line were constructed during Phase I.

Overall impacts to white-tailed deer due to construction of Phase I and the 500-MW Windplant would likely be negligible. Deer would

probably move away from construction activity associated with transmission line placement, but this disturbance would be short-term and limited in extent. Since few, if any, WTGs would occur within potential white-tailed deer habitat, operation of the Windplant would result in minimal disturbance to this species.

Impacts to elk habitat within the KPPA would be moderate during Phase I. However, impacts to elk range may become significant given the extent of habitat disturbance and potential displacement associated with the 500-MW Windplant. Approximately 318 ac of winter/yearlong range within the Snowy Range Elk Herd would be disturbed during Phase I construction; this represents 0.14% of this range type for the herd unit (Table 4.10). Phase I disturbance within winter/yearlong range would decrease to 68 ac (0.03%) following successful reclamation. The 500-MW Windplant would disturb 1,365 ac of winter/yearlong elk range, or 0.62% of this range type within the KPPA; 531 ac (i.e., 0.24%) would remain unavailable to elk during the LOP.

The construction and operation of the 500-MW Windplant may also significantly impact elk within the KPPA by displacing them from an area larger than that directly disturbed by project structures. In western Wyoming, elk have abandoned ranges in which oil and gas drilling and production activities have occurred (Johnson and Lockman 1980, Johnson and Wollrab n.d.). Elk returned to many of these ranges following the completion of drilling activity, but the pattern of elk use has remained unpredictable. Hayden-Wing Associates (1990) noted that elk in western Wyoming moved away from areas where oil field construction and drilling activities were occurring, but moved back again once intensive disturbance ceased. Some elk were observed using areas close to producing wells, but the density of elk remained lower near wells than in areas farther from production activities. In studies of elk response to seismograph exploration, visual (e.g., vehicles, personnel) and audible (e.g., vehicle noise, detonations) disturbances associated with this activity significantly affected elk movements, but not the distribution and range use of elk (Ward 1986, Gillin 1989). Elk tended to move quickly away from human activity and detonations, but returned to these areas within a day or two following disturbance. Simulated surface mine activities (e.g., recorded noise and human activity) in Idaho temporarily displaced elk, but had no effect on overall population fitness (Kuck et al. 1985). These researchers also determined that direct human harassment (i.e., human approach) elicited a greater flight response in elk than did other disturbance types. Although elk within the KPPA may habituate somewhat to the presence of operating WTGs, it is likely that vehicles and personnel traveling between and located at WTG sites would continue to displace elk. This type of "passive" disturbance (i.e., the mere presence of humans within an animal's home range) resulted in the extensive use and overgrazing of marginal areas of potentially available elk range in western Alberta (Morgantini and Hudson 1979).

In summary, impacts to elk within the KPPA from construction and operation of the proposed 500-MW Windplant could be significant. Although elk crucial range will not be disturbed by the proposed project, displacement and disruption of elk movement on winter/yearlong range by O&M activities could increase elk grazing pressure on unaffected range further from WTG locations. Monitoring of elk populations (and their response to O&M activities) during Phase I will clarify the level of potential impacts to elk within the KPPA resulting from development of the 500-MW Windplant.

Winter or winter/yearlong crucial range is very important to pronghorn (Guenzel 1986), mule deer (Mackie and Pac 1980, Carpenter and Wallmo 1981, Olson 1992), and elk (Adams 1982) populations in that it provides relief and survival opportunities during periods of adverse weather. For all three of these species, snow depth and condition is the primary factor governing use of crucial range (Gilbert et al. 1975, Bruns 1977, Yoakum 1978, Carpenter and Wallmo 1981, Adams 1982, Nelson and Leege 1982, Rudd 1982, Skovlin 1982, Guenzel 1986, Oedekoven and

Lindzey 1987). The energy costs of locomotion for a particular big game species are dramatically elevated in snow depths above front knee height (Parker et al. 1984). Melt-freeze and wind crusts that form on the surface of accumulated snow can prevent access to underlying vegetation (Carpenter and Wallmo 1981). It is likely that snow accumulation patterns on the KPPA would change as a result of WTGs and downtower structures, although the extent of these changes is not known (Tabler and Associates 1994). Since few, if any, WTGs or associated structures would be located within big game crucial range on the KPPA, impacts due to changes in snow accumulation would likely be negligible for this range type. However, big game moving through other winter or yearlong range types containing WTGs and associated structures may encounter areas of drifted snow that could impede movement. These drifts would probably not be extensive, and big game could move around them with relative ease. Large-scale habitat changes may occur (over many years) due to increased soil moisture from Windplant-induced snowdrifts; the extent and overall effect of these changes on big game distribution is presently unknown. Phase I monitoring will likely provide some trend information that may allow for reasonable predictions of long-term habitat changes.

In order to minimize potential impacts to crucial big game range within the KPPA, WTG placement would, if economically feasible, avoid these habitats. Transmission line and potential WTG construction and installation activities within crucial range would be scheduled during the period from May 1 through November 14 on public lands to prevent disturbance of wintering animals. Exceptions that allow these activities on public land crucial winter ranges may be granted by the AO if mild winter conditions prevail and ample foraging habitat remains for pronghorn and mule deer on adjacent areas.

The use of fencing within the Windplant would be very limited; chain-link fences would be used to prevent big game, livestock, and people from entering the Windplant substations. Since individual WTGs and WTG strings would not be fenced, it is anticipated that big game movement through the Windplant would not be curtailed or hindered. I-80, located immediately south of the KPPA, acts as an existing barrier to big game movement, especially elk (Ward 1973). Although elk may occasionally feed near I-80, few individuals actually cross the highway due to game fences and heavy traffic (Ward et al. 1973). The traditional migratory movement of elk between winter range (located north of I-80, for the most part) and summer range (located south of I-80) has been permanently disrupted due to the presence of the I-80; in essence, two separate populations of elk exist in the area, one north and the other south of I-80. It is likely that foraging movements of other big game species (i.e., pronghorn, mule deer, and white-tailed deer) have also, at least to some extent, been curtailed.

A slight increase in big game harvest (both legal and illegal) may occur due to increased access through new road development associated with the proposed Windplant. However, access is controlled on private land by landowners, and this would continue to be the case following Windplant construction. KENETECH has committed to educating employees regarding WGFD rules and regulations for the area, and project personnel would support WGFD surveillance in the area by immediately reporting all observed illegal harvesting of wildlife or other mortality of important wildlife on the KPPA.

Since noise associated with WTG operation within the KPPA would only occasionally exceed the ambient background noise (see Section 4.1.8.2), it is likely that the overall effect of WTG noise on big game would not represent a significant impact. Animals (including big game) generally respond to an unusual sound by fleeing the source of the sound; subsequent behavior toward that sound, however, depends on experiences associated with the sound (Geist 1978). If the sound persists and remains localized, and animals can approach or withdraw from the source of their own volition (as with WTGs), animals will likely, over time, ignore the sound. Noise associated with project vehicles

and O&M activities may be more disturbing to big game within the KPPA due to its irregular and unpredictable nature. Big game, especially elk, may respond to this type of noise by moving some distance from the source and returning only when the source has left the area. Monitoring during Phase I will provide insight into the extent of disturbance to big game from WTG and vehicle noise.

Alternative A. Big game habitat disturbance associated with construction of Alternative A would, for the most part, be approximately 60% of that occurring due to 500-MW Windplant construction (Table 4.10). Approximately 106 ac of crucial winter/yearlong range within the Medicine Bow Pronghorn Herd would be initially disturbed under Alternative A; this acreage represents 0.05% of this range type within the herd unit. LOP disturbance within pronghorn crucial range would decrease to 23 ac (i.e., 0.01%) with successful reclamation. Habitat loss within mule deer crucial winter/yearlong range for the Sheep Mountain Herd would remain the same as that for Phase I and 500-MW Windplant construction [i.e., 42 ac (0.03%) of new disturbance, and 0 ac LOP]. Impacts to the Medicine Bow Pronghorn Herd and the Sheep Mountain Deer Herd crucial winter/yearlong range would be moderate under Alternative A. The Platte Valley Mule Deer Herd would experience a negligible loss of 0.01% of winter/yearlong range (99 ac) and 0.07% of yearlong range (141 ac) due to the initial construction of Alternative A. Other big game range that would be impacted the same under Alternative A and the Proposed Action are yearlong range for the Shirley Mountain Mule Deer Herd (i.e., 2 ac new, 0 ac LOP) and Laramie River White-tailed Deer Herd (i.e., 15 ac new, 0 ac LOP). Impacts to the Snowy Range Elk Herd would be potentially significant under Alternative A due to both a 0.4% loss of winter/yearlong range (890 ac) and possible displacement from habitat adjacent to WTGs.

Other potential impacts to big game (e.g., displacement, noise, snow accumulation) would continue to be present under Alternative A, but may decrease somewhat in intensity and/or distribution.

No Action. No impacts to big game species or their habitats within the KPPA would occur under the No Action Alternative.

Cumulative Impacts. Habitat disturbance associated with Phase I activities represents 0.1% or less of various big game ranges (including crucial ranges) for the herd units of interest (Table 4.10). The largest percentage of big game range types disturbed by construction of the 500-MW Windplant would be winter/yearlong range for Medicine Bow Pronghorn (0.21%), Sheep Mountain Mule Deer (0.19%), and Snowy Range Elk (0.62%) Herds. Disturbance within winter/yearlong range for the Medicine Bow Pronghorn and Sheep Mountain Mule Deer Herds would decline to less than 0.10% of that available within the herd unit for the LOP. For the Snowy Range Elk Herd, LOP disturbance within winter/yearlong range would decline to 0.24% of that available within the herd unit.

Existing and foreseeable disturbance (e.g., oil and gas development, proposed windpower development, surface mining, roads) within crucial big game habitat for herds of interest are presented in Table 4.11. According to the significance criterion stated above, crucial habitat within each of the big game herd units currently is significantly impacted by existing and foreseeable disturbance. Indirect impacts to big game, such those related to noise and human disturbance (i.e., displacement), are difficult to quantify, but probably increase the overall level of cumulative disturbance within crucial range. The 140 ac of crucial winter/yearlong pronghorn range within the Medicine Bow Herd that would be disturbed by construction of the 500-MW Windplant represents an increase in total cumulative acreage of disturbance to this range of approximately 1.6%, for a total disturbance of 9,169 ac. Likewise, 500-MW Windplant development would result in an increase of 0.9% (42 ac) to existing cumulative acreage of disturbance within the crucial winter/yearlong range for the Sheep Mountain

Table 4.11 Cumulative Existing and Foreseeable Disturbance Within Crucial Habitat for Big Game Herd Units and Sage Grouse HMP Areas.[1]

	Pronghorn	Mule Deer			Elk	Sage Grouse
Disturbance Type	Medicine Bow Herd	Platte Valley Herd	Sheep Mountain Herd	Shirley Mountain Herd	Snowy Range Herd	Shirley Mountain and Saratoga Valley HMP Areas[2]
Oil and gas production[3]	14	0	48	0	20	11
Surface mining	435	0	410	0	0	14,289
Proposed Medicine Bow windfarm[4]	1,277	0	67	0	0	874
Urban development	273	0	8	0	5	179
Federal highway (i.e., I-80)[5]	642	715	376	0	0	188
State highways[6]	752	238	295	0	0	653
Other roads[7]	4,138	3,693	2,874	1,562	3,475	5,455
Railroad ROWs[8]	713	577	262	0	0	684
Pipeline ROWs[9]	459	183	111	37	66	420
Other[10]	326	54	40	32	19	170
Total disturbance	9,029	5,460	4,491	1,631	3,585	22,923
Total acreage of crucial habitat	227,584[11]	208,256[11]	158,080[11]	85,888[11]	191,104[12]	300,000[13]
Percentage of crucial habitat disturbed[14]	4.0	2.6	2.8	1.9	1.9	7.6

1 Disturbance calculated from 1:100,000 topographic maps and industry data; all disturbances in ac, and includes only acreage physically disturbed by development activities; multiply number of ac by 0.4047 to compute number of hectares.
2 Adapted from Medicine Bow-Divide Resource Area RMP data (BLM 1987:200).
3 Average oil/gas well disturbance considered to be 1.5 ac/well, which includes disturbance from associated access roads.
4 Approximate disturbance acreage based on initial project description submitted to BLM.
5 I-80 ROW = 500 ft (152 m).
6 State highway ROW = 100 ft (31 m).
7 Other roads include primary and secondary (i.e., local) roads; ROW = 50 ft (15 m).
8 Railroad ROW = 200 ft (61 m).
9 Pipeline ROW = 50 ft (15 m).
10 Other disturbances include airports, gravel pits, irrigation ditches, landing strips, quarries, and reservoirs.
11 Total acreage of crucial winter/yearlong range for the herd (WGFD 1994a).
12 Total acreage of crucial winter and crucial winter/yearlong range for the herd (WGFD 1994a).
13 Probable sage grouse nesting habitat includes areas within 2.0 mi (3.2 km) of known lek sites on HMP areas; adapted from BLM (1987:200) data.
14 Percentage of crucial habitat disturbed = $\frac{\text{total acreage of disturbance}}{\text{total acreage of crucial habitat}} \times 100$

Mule Deer Herd, for a total disturbance of 4,533 ac. Crucial range within the Platte Valley and Shirley Mountain Mule Deer Herds, as well as that within the Snowy Range Elk Herd, would not be additionally impacted by Windplant development. Although Windplant development may result in a slight increase in cumulative disturbance to some big game ranges (e.g., winter/yearlong range for elk), it would not substantially increase cumulative disturbance within crucial ranges for big game herds on and adjacent to the KPPA.

4.2.3.2 Other Mammals

Significance Criteria. Quantifiable criteria that specifically define the level at which disturbance of nongame (i.e., furbearers and other carnivores) and small mammal (i.e., insectivores, lagomorphs, and rodents) habitats becomes a significant impact to population health are not designated in the literature or by regulatory agencies. For this EIS, however, impacts to nongame and small mammals would be considered significant if project activities result in a decline in populations of these species.

Proposed Action. While nongame and small mammals would be negatively affected by increased traffic and human presence (i.e., O&M activities) within the KPPA, primary effects would occur in direct proportion to the amount of potential habitat removed by project construction. Approximately 319 ac of potential habitat would be disturbed due to Phase I construction, which represents approximately 0.5% of potential habitat within the KPPA. Construction of the 500-MW Windplant would disturb approximately 1,787 ac of potential nongame and small mammal habitat, or about 2.9% of the KPPA. Overall impacts to nongame and small mammal populations within the KPPA would likely be negligible due to the scattered distribution and extent of potential disturbance. A slight increase in direct nongame and small mammal mortality would initially occur due to Phase I and 500-MW Windplant construction, and would remain slightly elevated for the LOP due to increased traffic; this impact to populations would also likely be negligible.

Localized changes in nongame and small mammal habitats may occur as a result of changes in snow accumulation patterns induced by WTG placement (Section 4.1.1). For example, greater available moisture resulting from increased snow cover immediately downwind from a WTG array could, over several years, encourage shrub growth and change the microstructure of the present habitat. Although this may not be detrimental to the overall population of a given nongame or small mammal population within the KPPA, distribution patterns for these species may change; the extent of this change is difficult to predict. These changes may be significant for a localized area, but would tend to be moderate when considered for the entire KPPA. Also, the same changes that might be considered negative for a grassland species (i.e., change in forage species and increase in vertical structure) may be considered positive for a shrub-grassland species.

Alternative A. Impacts to habitats used by nongame and small mammals under this alternative would decrease by about 40% from levels identified for the Proposed Action. Therefore, impact levels would likely remain negligible.

No Action. No impacts would occur to nongame and small mammal populations within the KPPA under the No Action Alternative.

Cumulative Impacts. Regional cumulative impacts to nongame and small mammal habitats include mines (i.e., approximately 22,598 ac of disturbance, 5,741 ac of which is active at any one time), oil and gas development, proposed windpower development (i.e., 1,344 ac of potential disturbance from the proposed Medicine Bow Windfarm) and roads (e.g., federal and state highways, primary and secondary roads). The majority of this disturbance is scattered throughout the region, and probably presents a negligible impact to nongame and small mammal populations. Maximum cumulative disturbance within the KPPA (i.e., construction of the 500-MW Windplant plus existing disturbance) would total 2,226 ac, or 3.7% of the potential nongame and small mammal habitat within the KPPA. By

implementing prompt revegetation and appropriate habitat protection measures (Section 5.1.3.10), cumulative impacts to nongame and small mammal populations within the region are expected to be negligible.

4.2.3.3 Legislation Related to Avian Mortality

The USFWS has contended that, in some circumstances, avian collision-related mortality may constitute violations of the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-711, as amended), the Bald Eagle Protection Act (BEPA) (16 U.S.C. 668-668d, as amended), the Endangered Species Act (ESA) (16 U.S.C. 1531-1543) and/or Wyoming Statutes 23-1-101 and 23-3-101 unless appropriate permits are obtained and steps are taken to minimize detrimental impacts. The MBTA provides for regulations to control taking, selling, transporting, and importing migratory birds, their nests, eggs, parts, or products. Migratory birds include all birds in North America except gallinaceous birds (e.g, grouse, turkey, quail), starlings, rock doves/pigeons, and house sparrows. Migratory game birds (i.e., ducks, geese, cranes, and mourning doves) may be taken during seasons set by the state of Wyoming in conjunction with the USFWS.

These laws were primarily designed to penalize active, intentional conduct such as unpermitted hunting or commercial use. There have been conflicting court decisions about whether and in what circumstances these taking prohibitions apply to unintentional conduct such as the construction or maintenance of facilities with which birds or other protected species might collide or otherwise be harmed. USFWS has issued a memorandum which focuses the inquiry in these circumstances on the windpower developer's efforts to reduce the impacts on wildlife and to develop safer windpower technology, rather than viewing individual collisions as violations of the law. USFWS has not yet determined whether particular avian mortality permits will be required for Windplant installation, insofar as it will not consider takings violations to occur where the operator is exercising such appropriate care.

The MBTA provides for the issuance of Migratory Bird Permits (50 C.F.R. 21) to allow take of migratory birds for various purposes such as falconry, scientific research, control of depredation, or special purposes. Special purpose permits (50 C.F.R. 21.27) ". . . may be issued for special purpose activities related to migratory birds . . . .". Such an application must show " . . . a benefit to the migratory bird resource, important research reasons, reasons of human concern for individual birds, or other compelling justification" in addition to other general permit requirements (50 C.F.R. 13).

The ESA provides for the conservation of T&E species. Mortality or injury to T&E avian species known to occur (bald eagle and peregrine falcon) or potentially occur (whooping crane) within the KPPA might, in some circumstances, be considered a take under the ESA. Regulatory provisions of the ESA (50 C.F.R. 17.22) provide for the issuance of an Incidental Taking Permit which may authorize a single transaction, a series of transactions, or a number of activities over a specific period of time. Incidental taking is defined as " . . . any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." (50 C.F.R. 17.3). Permit applications require the filing of a conservation plan which specifies:

- impacts that would result from the incidental take;
- steps the applicant will take to monitor, minimize, and mitigate identified impacts, and the funding available to implement such measures; and
- any alternative actions considered to the take and the reasons such alternatives were not adopted.

Permits may be issued if:

- the take is incidental,
- the applicant will, to the maximum extent practicable, minimize and mitigate impacts of the take;
- adequate funding is provided for the conservation plan;
- the take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and
- the applicant meets any other requirements imposed by the Director of the USFWS.

The BEPA provides for the protection of bald eagles and golden eagles by prohibiting the taking, possession, and commerce of these birds. The BEPA also provides for the issuance of taking permits for scientific or exhibition purposes, for Native American religious purposes, for taking depredating eagles, for falconry purposes, and for taking golden eagle nests. There are no regulatory provisions for incidental takings as there are under the ESA or MBTA.

WGFD laws afford protection to protected birds (W.R.S. 23-1-101), and specifically, eagles (W.R.S. 23-3-101). Permits may be issued to allow work with birds for scientific, falconry, or other purposes authorized by the Wildlife Commission.

While it is relatively certain that some migratory birds or other protected species would collide with Windplant structures, the USFWS generally supports windpower development to provide a clean, renewable energy source. In early 1994, the USFWS developed a written policy regarding the effects of wind turbines on wildlife:

> The policy is that the Service will enforce regulations associated with the Migratory Bird Treaty Act, 16 U.S.C. 703-712 (sic), the Bald and Golden (sic) Eagle Protection Act, 16 U.S.C. 668, and the Endangered Species Act.
>
> The Service supports the Administration's goal of developing and expanding renewable energy sources such as windpower. Therefore, the Service will assist the windpower industry with development of windpower technology that is not detrimental to wildlife. Hopefully such actions as modification of site placement, changes in operating schedules, and equipment modification can be developed to reduce the impact of windpower on wildlife.

The USFWS has a stated intent "to improve communications, working relationships with the industry, and to assist with development of safer windpower technology . . . .". Which permits would be issued and what conditions would be included for the Proposed Action have not yet been determined, and negotiations between KENETECH and the USFWS are on-going. Whether or not a permit for limited taking of protected species is issued, the USFWS may direct that the Windplant be constructed and operated to meet certain stipulations to reduce impacts to birds and other wildlife. Stipulations would include, but are not limited to, using state-of-the-art technology known to minimize wildlife impacts [e.g., using results of research conducted by the avian task force (see Section 2.1.11)], locating facilities away from known avian concentration areas, and scheduling Windplant operations to avoid disturbing avian wildlife during defined critical periods. These negotiations have lead to the proposed use of tubular towers rather than lattice towers for the proposed project because, in some circumstances, with some facilities in California, lattice towers appear to cause greater avian mortality than tubular towers (Orloff and Flannery 1992).

4.2.3.4 Raptors

Significance Criteria. Impacts to raptors would be considered significant if project-related activities resulted in:

- violation of the MBTA, the BEPA, and/or the ESA; and/or
- declining raptor populations.

Proposed Action. Potential impacts of the proposed Windplant to raptor populations could be direct or indirect. The direct effect would be collision-related mortality; indirect effects would include changes in essential habitat components (e.g., prey availability, nesting sites) which may indirectly affect mortality rates and/or raptor reproductive success. Both direct and indirect impacts are potentially significant.

The proposed Windplant would be the first industrial scale windpower facility in Wyoming, and potential raptor mortality is unknown. Two large [257 ft (78 m) and 300 ft (91 m) rotor diameter] wind turbines near Medicine Bow, Wyoming were monitored for a six-year period from 1978 to 1983 (Yeo et al. 1984). No raptor mortalities were recorded at either turbine, but these results are not entirely applicable to the Proposed Action since turbine types, location, size, and numbers are dramatically different. Raptor mortality studies have been conducted at Windplants in California (i.e., Altamont Pass and the Montezuma Hills), where a wide variety of turbine types is used (Howell and DiDonato 1991, 1989, 1988; Howell and Noone 1992; Howell et al. 1991a, 1991b; Orloff and Flannery 1992). The methodology used to document mortality in California is limited to estimating the species and number of birds killed, but not effects on populations. Birds were not marked, hence impacts of turbine mortality on local raptor populations cannot be quantitatively evaluated because it is not known in what proportions breeding birds and floaters (i.e., nonbreeding, nonresident birds) were killed. Furthermore, only one California study evaluated potential changes in raptor densities after windfarm construction by measuring raptor abundance during both pre- and post-construction of the Montezuma Hills windfarm (Howell and Noone 1992).

Researchers at California Windplants have concluded that the magnitude of turbine-caused raptor mortality is related to raptor abundance, behavior, and flight characteristics (Howell and DiDonato 1991, Howell and Noone 1992, Orloff and Flannery 1992). The turkey vulture was the most commonly seen raptor at California Windplants, but had very low mortality (Table 4.12), possibly because scavenging does not involve high-speed flight or highly focused concentration. Conversely, hunting birds like the American kestrel, which had a higher mortality rate than predicted from its relative abundance, may be less aware of obstacles in their flight path (Orloff and Flannery 1992). In addition to flight behaviors such as flight speed, flight height may also contribute to risk of turbine collision; those species that typically fly at rotor height [26-184 ft (8-56 m)] would have a greater risk of collision. Flight-height data collected on Foote Creek Rim show that 49% of eagles observed, 53% of hawks observed, and 62% of large falcons (prairie falcon, peregrine falcon) observed were within the turbine rotor height class; while 27% of small falcons (American kestrel, merlin), 15% of northern harriers, and 17% of accipiters were observed in the turbine rotor height class (Table 3.12). Given the characteristics that may contribute to turbine collision, it is possible to rank species in order of potential risk of collision. The most abundant species with hunting flight behavior that flies at rotor height may have the greatest risk of collision; while uncommon, high-flying, scavenging raptors would potentially have the lowest risk of turbine collision (Howell and DiDonato 1991, Howell and Noone 1992, Orloff and Flannery 1992).

The populations of most raptor species observed on the KPPA (except for federally listed, or candidate species) are generally assumed to be widely distributed and stable (Olendorff 1973, Newton 1979). However, while abundance (i.e., average occurrence) has been calculated for raptor species seen on Foote Creek Rim (Table 4.12), there is a lack of accurate information on local raptor population structures (personal communication, January 1995, with Tamara Holmes, University of Colorado Health Sciences). If raptor populations are, in fact, widely distributed and panmictic (random breeding within a population), resident birds killed by the Windplant would probably be replaced by immigrating individuals and populations may not

Table 4.12 Average Occurrence Per 10-min Scan for Raptors at California Windfarms and at Foote Creek Rim, Wyoming, and Number of Carcasses Recovered at California Windfarms for Each Species.[1]

	Location										
	Altamont Pass						Montezuma Hills			Foote Creek Rim	
Species	No. Observed per 10-min Scan[2,3]	Rank	No. Carcasses Recovered	Occurrence[2,4] (No. Observed per 10-min Scan)	Rank	No. of Carcasses Recovered	Occurrence[2,5] (No. Observed per 10-min Scan)	Rank	No. Carcasses Recovered	Occurrence (No. Observed per 10-min Scan)	Rank
American kestrel	0.046	5	0	0.053	4	20[6]	0.362	3	5	0.121	2
Bald eagle	0.000	–	0	0.012	7	0	<0.001	9	0	0.012	7
Ferruginous hawk	0.056	4	0	0.051	5	2	0.020	7	0	0.053	4
Golden eagle	0.198	3	2[6]	0.194	3	16[8]	0.090	5	1	0.289	1
Northern harrier	0.010	7	0	0.014	6	0	0.138	4	0	0.039	5
Prairie falcon	0.014	6	0	0.008	8	0	0.076	6	0	0.034	6
Peregrine falcon	0.000	–	0	0.002	9	0	<0.001	9	0	0.006	9
Red-tailed hawk	0.356	2	9[6]	0.301	2	54[8]	0.800	2	6	0.099	3
Swainson's hawk	0.000	–	0	0.000	–	0	0.001	8	0	0.034	6
Turkey vulture	0.415	1	0[7]	0.356	1	0[7]	1.150	1	0[7]	0.003	8

1 California average occurrence is for all seasons and years combined; Foote Creek Rim average occurrence is calculated from weekly raptor surveys conducted from June 29 through October 26, 1994 (Foote Creek Rim raptor surveys will continue indefinitely) (Mariah 1994a). The Foote Creek Rim portion of the table includes only those species for which occurrence data were available for comparison.
2 See Table 4.13 for study methodology.
3 Howell and DiDonato (1991).
4 Orloff and Flannery (1992).
5 Howell and Noone (1992).
6 Turbine-caused mortality was higher than predicted from relative abundance.
7 Turbine-caused mortality was lower than predicted from relative abundance.
8 Turbine-caused mortality of adults and immature birds was higher than predicted from relative abundance.

decline. However, if a population structure were such that recruitment was local, Windplant-related mortality might conceivably have a significant impact on some populations. Regardless of population structure, there is the potential for loss of production through nest abandonment if a parent bird is killed by turbine collision. Because total number of nesting territories and geographic origins of resident birds and their movement patterns are unknown for this area, potential impacts on raptor populations are difficult to quantify.

For the purposes of this EIS, the number of raptor carcasses collected at California windfarm sites was used to estimate mortality rates for four raptor species (American kestrel, ferruginous hawk, golden eagle, red-tailed hawk) common to both Wyoming and California for which carcasses were recovered in California (Howell and Noone 1992, Orloff and Flannery 1992). California data are being used because California windfarms are the only source of large-scale Windplant mortality estimates available. Estimated mortality rates presented herein are subject to many assumptions and possible large errors (see below). These calculations provide only an initial estimate of potential mortality, which would be revised and improved during monitoring.

California mortality rates for the four raptor species were calculated by dividing the number of individuals of each species killed per unit time by the number of turbines sampled (Tables 4.13 and 4.14). The California mortality rates were applied to the proposed Phase I and the 500-MW Windplant (Table 4.14). For example, average annual golden eagle mortality at Altamont Pass, California, was 8 carcasses; this number was divided by 1,169 turbines for an annual mortality rate of 0.007 raptors/turbine (Orloff and Flannery 1992). This rate was multiplied by number of turbines proposed for Phase I and the 500-MW Windplant to generate the annual mortality estimates listed in Table 4.14.

Based on California mortality rates, golden eagle mortality is predicted to range from 0.402 ($\pm$0.569) to 1.307 ($\pm$0.995) eagles per year for Phase I (201 turbines), and 2.780 ($\pm$3.932) to 9.035 ($\pm$6.880) eagles per year for the 500-MW Windplant (Table 4.14). This may be an underestimate because golden eagles are more abundant on the KPPA then at the California Windplant (Table 4.12). Furthermore, both adult and immature golden eagles were killed more often than expected by their abundance (Table 4.12) (Howell and DiDonato 1991, Orloff and Flannery 1992).

Possible ferruginous hawk mortality at the proposed Windplant is a concern because the ferruginous hawk is a C2 species. No ferruginous hawks were recovered from the Montezuma Hills Windplant. Based on Altamont Pass data, estimated average mortality would be 0.201 birds per year for Phase I, and 1.390 birds per year for the 500-MW Windplant (Table 4.14). This species breeds in Wyoming (17 active nests in the 1994 nest survey area), but only winters in California, so the mortality estimate is probably low (Table 4.14).

Estimated American kestrel mortality would range from 1.709 ($\pm$1.279) to 2.513 ($\pm$0.142) per year for Phase I, and 11.815 ($\pm$8.846) to 17.375 ($\pm$0.983) per year for the Proposed Action. This estimate may be low because carcasses are difficult to recover since this raptor's small size may result in increased scavenging rates and decreased searcher efficiency. Scavenging trials conducted at California Windplants demonstrated that eagle-sized raptors were not removed by scavengers, whereas about one-half of all kestrel-sized raptor carcasses were removed after seven days (Howell and Noone 1992, Orloff and Flannery 1992). However, American kestrels are year-round residents at the California site, while most leave southern Wyoming during winter, which may partially offset the small carcass recovery bias (Table 4.14).

Estimated red-tailed hawk mortality ranges from 1.910 ($\pm$1.848) to 5.025 (no standard deviation associated with this number) per year for Phase I, and 13.205 ($\pm$12.770) to 34.750 (no standard

Table 4.13 Average Number of Raptor Carcasses Recovered Annually at Five Wind Turbine Sites and Description of Sampling Characteristics.

Investigator	Species: American Kestrel (Mean ±SD)	Golden Eagle (Mean ±SD)	Ferruginous Hawk (Mean ±SD)	Red-tailed Hawk (Mean ±SD)	Sampling Characteristics: Sampling Period	No. Turbines Sampled	Primary Tower Type
Howell and Noone (1992)[1]	2.5 ± 0.71	0.5 ± 0.71	0	3 ± 2.83	2 years/weekly search year-round	170 (1st yr.); 230 (2nd yr.)	Lattice
Orloff and Flannery (1992)[2]	10 ± 7.10	8 ± 5.66	1 ± 0[3]	27 ± 11.31	2 years/weekly search for 3 five-week sampling periods each year	1,169	Lattice
Howell and DiDonato (1991)[2]	0	2 ± 0	0	9 ± 0	1 year/twice monthly search, year-round	359	Lattice
Howell (unpubl. data)[4]	0	0	0	0	1 year/twice weekly searches, year-round	39	Lattice
Higgens (unpubl. data)[5]	0	0	0	0	May - Sept. 1994/weekly search	Random sample of 73	Tubular

1 Turbines located in Montezuma Hills, California.
2 Turbines located at Altamont Pass, California.
3 Standard error is 0 because only one carcass was recovered each year.
4 Turbines located in California (personal communication with Judd Howell, Judd Howell and Associates, September 1994).
5 Turbines located in Minnesota (personal communication with Kenneth Higgens, South Dakota State University, October 1994).

Table 4.14 Estimated Average Number of Raptor Carcasses that Would Be Recovered Annually from the Wyoming Windplant Using Carcass Recovery/Turbine Rates from Three California Windfarm Studies.[1]

Species	Average Mortality/Turbine/ Year ± SD	Estimated Mortality/Year ± SD		
		Phase I (201)[2]	Full (1,390)[2]	Alternative A (835)[2]
A.[3]				
American kestrel	0.009 ± 0.006	1.709 ± 1.279	11.815 ± 8.846	7.098 ± 5.314
Ferruginous hawk	0.001[4]	0.201	1.390	0.835
Golden eagle	0.007 ± 0.005	1.307 ± 0.995	9.035 ± 6.880	5.428 ± 4.133
Red-tailed hawk	0.010 ± 0.009	1.910 ± 1.848	13.205 ± 12.770	7.933 ± 7.676
B.[5]				
American kestrel	0.013 ± 0.001	2.513 ± 0.142	17.375 ± 0.983	10.438 ± 0.590
Golden eagle	0.002 ± 0.003	0.402 ± 0.569	2.780 ± 3.932	1.670 ± 2.362
Red-tailed hawk	0.014 ± 0.011	2.814 ± 2.274	19.460 ± 15.726	11.690 ± 9.447
C.[6]				
Golden eagle	0.006[7]	1.206	8.340	5.010
Red-tailed hawk	0.025[8]	5.025	34.750	20.875

1 See Table 4.13 for sampling method description.
2 Proposed number of turbines noted in parentheses.
3 Orloff and Flannery (1992).
4 No standard deviation (SD) associated with this number, since sample size was 1 for both years (i.e., SD = 0)
5 Howell and Noone (1992).
6 Howell and DiDonato (1991).
7 This number is not an average because carcasses were collected for only one year.
8 This number is based on one year of data, and therefore, is not an average and has no SD associated with it.

deviation) per year for the 500-MW Windplant. California researchers reported that both immature and adult red-tailed hawks were killed more often than would be predicted by their relative abundance (Howell and DiDonato 1991, Orloff and Flannery 1992). However, red-tailed hawks are not nearly as abundant in the KPPA as they are at Altamont Pass or Montezuma Hills (Table 4.12); hence, this mortality estimate may be high.

Due to numerous physical and biological differences between California and the proposed Wyoming Windplant sites, these raptor mortality estimates are limited and most likely will change as data are collected during monitoring (Appendix B). Specific limitations of using California mortality data to estimate wind turbine-caused mortality within the KPPA include, but are not limited to:

- Mortality rates in California were highly variable both temporally and spatially, causing large standard deviations for estimated average raptor mortality (Table 4.14). Seasonal, yearly, and spatial variation in mortality (e.g., Foote Creek Rim vs. the Simpson Ridge area) should be expected at the proposed Wyoming Windplant as well. For example, given the decline in raptor observations during winter [Figure 3.2(C and D)], it is expected that potential raptor mortality will be much lower during winter than during other seasons. Hence, actual annual mortality rates may not fall within the estimated ranges.
- Carcasses were primarily recovered from turbines on lattice towers. Orloff and Flannery (1992) associated lattice towers with higher raptor mortality rates compared to other turbine types. Tubular towers associated with lower raptor mortality rates in preliminary research (Table 4.13) would be used for the Proposed Action. Other turbine differences (e.g., operation time, rotor color, variable speed vs. fixed speed, upwind vs. downwind, turbine design, rotor diameter, swept area, etc.) may also affect mortality rates, but the influence of these turbine modifications on raptor mortality cannot be quantified at this time (Section 5.1.3.11).
- Twenty-five off-site raptor mortalities (including seven golden eagles) were reported at Altamont Pass (Orloff and Flannery 1992), and six off-site raptor mortalities were reported at Montezuma Hills (Howell and Noone 1992), but could not be directly linked to turbine collisions (i.e., the mortality occurred due to the Windplant, but specific cause of death could not be accurately determined) and thus, were not included in KPPA mortality estimates.

A final limitation of the California mortality estimates is that nesting densities are not comparable between sites because the California reports do not always state the site of the area surveyed. Furthermore, the effect of nest density on turbine-caused mortality for raptor species remains unknown. For example, Montezuma Hills and Altamont Pass Wind Resource Areas (WRAs) had similar raptor mortality rates, although raptor nesting density was higher at Montezuma Hills than at Altamont Pass (Howell and Noone 1992, Orloff and Flannery 1992). Also, Howell and DiDonato (1991) reported an inverse relationship between avian mortality and nesting densities at Altamont Pass where one site with 19 raptor nests had a significantly lower raptor mortality rate than another site with 7 nests. Orloff and Flannery (1992) reported that raptor mortality was randomly distributed throughout the Altamont Pass WRA.

Turbine-caused mortality for common raptors not listed in Table 4.14 cannot be quantified due to lack of mortality data for these species. No bald eagle, prairie falcon, Swainson's hawk, or northern harrier carcasses were recovered at either California site, although one prairie falcon was recovered off-site (Howell and Noone 1992). However, because of higher abundances of these species within the KPPA compared to California (Table 4.15), mortality of these species is likely

Table 4.15 Comparison of Raptor Species Distribution[1] in Southern Wyoming vs. California.

Species	State: Wyoming	State: California
Bald eagle[2,4]	Resident[3], infrequent, winter population increases	Resident, infrequent
Golden eagle[4]	Resident, common	Resident, common
Ferruginous hawk[5]	Seasonal resident, common during breeding season, rare during winter	Does not breed in California, uncommon winter resident
American kestrel	Seasonal resident, common during breeding season, some stay through winter	Resident, common
Merlin	Resident, uncommon during breeding season to rare during winter	Common winter resident
Northern harrier	Seasonal resident, common during breeding season, some stay through winter	Resident, common, population declining throughout California[6]
Prairie falcon	Resident, common, larger breeding population on KPPA than at California windfarms	Resident, uncommon
Red-tailed hawk	Resident, common	Resident, common
Rough-legged hawk	Common winter resident	Common to uncommon winter resident
Swainson's hawk	Seasonal resident, common during breeding season	Uncommon during breeding season[7]

1 Distribution information taken from Wyoming Bird and Mammal Atlas (WGFD 1992), and Field Guide to the Birds of North America (Scott 1987).
2 Federally endangered.
3 Breeds and remains in the area year-round.
4 Protected under the BEPA.
5 Federal candidate species: C2.
6 Species of special concern in California [California Department of Fish and Game (CDFG) 1991].
7 California threatened (CDFG 1991).

under the Proposed Action. Most notably, active bald eagle, prairie falcon, and Swainson's hawk nests were located within the 1994 raptor survey area (Table 3.13), and none of these species nested in California Windplant areas.

Although most documented on-site mortality in California was directly associated with collisions with wind turbines, other Windplant facilities may also impact raptors. Collisions with electrical and guy wires caused 18% of raptor deaths in Altamont Pass (Orloff and Flannery 1992). Facilities within the KPPA would be constructed to minimize impacts to raptors. The 230-kV transmission line would be constructed as recommended by Olendorff et al. (1981) to eliminate potential for raptor electrocution. Ground wires would be marked where the transmission line crosses the Medicine Bow River and Foote Creek. Transmission lines would be periodically monitored; if some portions of the lines have high collision rates, ground wires in these areas would be marked.

In addition to potential direct effects (mortality), indirect effects on raptor populations are also possible (changes in perching, foraging, or nest site availability). The proposed 500-MW Windplant could potentially impact raptor use within and adjacent to the KPPA (Table 3.11). Although many Windplant facilities would be equipped with antiperching devices, raptor perching within the KPPA is expected to increase. There are very few perching sites in the Foote Creek Rim area, so any facilities that afford a view would probably be used by raptors. Raptors have been observed perching on meteorological towers, idle turbine blades and on power lines (Smith 1985, Faanes 1987, Howell and Noone 1992, Orloff and Flannery 1992, Mariah Associates Inc., 1994a). No raptors have been observed perching on WTGs with tubular towers (personal communication, September 1994, with Judd Howell, Judd Howell and Associates), but it is possible that they can be used as perch sites. Other perching sites created by the Windplant would include fencing around substations, transformers, downtower boxes, and power lines. Power line structures within the Windplant would be equipped with antiperching devices, and the 230-kV transmission line would be equipped with antiperching devices in the vicinity of prairie dog colonies and sage grouse leks to minimize predation on BFFs and sage grouse (Sections 4.2.4.2 and 4.2.3.5). Raptors that frequently perch on or near turbines may habituate to turbines, resulting in a decreased awareness of danger (Orloff and Flannery 1992); but this has not been tested, and effects of habituation to turbines on raptor mortality remains unknown.

Food availability is one of two primary factors that may potentially limit raptor populations (Newton 1991). Impacts of the Proposed Action on prey availability are unknown, but would be monitored beginning with Phase I of development (Appendix B). If prey availability decreases, raptor reproductive success and/or winter survival could also decrease. Alternatively, prey increases within the KPPA could improve reproductive success; however, increased prey could also attract raptors to turbine sites, possibly resulting in increased raptor collision rates.

Nest site availability, the other principal potential limiting factor of raptor populations, is probably not limited within the KPPA. In 1994, 308 active and/or inactive nests were known to occur within the KPPA. The total number of nests does not represent the total number of territories because each territory may have two to three alternate nests (Newton 1979). History of territory occupancy is unknown for the KPPA, hence average annual number of occupied territories in the area is also unknown. However, given the large number of raptor nests within KPPA, suitable nest sites are probably not limiting for most species. Erection of wind turbines would not increase nest site availability because raptors probably would not be able to build nests on tubular turbines (personal communication, September 1994, with Judd Howell, Judd Howell and Associates). Raptors nest on poles along transmission lines (Steenhoff et al. 1993), and although wildlife boots will be placed on poles above sage grouse leks and prairie dog towns to

prohibit nesting in these areas, the numerous other power line structures could provide nest sites. On- or off-site mitigation may include erection of nesting platforms.

The Hanna RCA overlaps with the Simpson Ridge portion of the KPPA, and density of raptor nests in this area is higher than anywhere else within the 1994 nest survey area (Section 3.2.2.3). Raptor displacement from this preferred habitat could adversely affect populations because displaced birds could be forced to utilize other less suitable areas which may result in lower reproductive success. The availability of alternate nest sites and adequate prey would affect the magnitude of this impact. Available nesting habitat could decrease through physical loss of land (Table 4.1) as well as human disturbance (e.g., construction and O&M activities). No project-related activities would occur from February 1 through August 1 within the 0.75-mi (1.21-km) buffer around each active nest, unless otherwise approved by the BLM.

In summary, raptor mortalities have been reported at Windplants in California, which suggests that turbine-caused raptor mortality will occur due to the Proposed Action. The most abundant raptor species that tend to fly at wind turbine rotor height may have the highest risk of turbine collision (Howell and Noone 1992, Orloff and Flannery 1992). Two primary raptor species of concern which occur on the KPPA are the golden eagle and ferruginous hawk; both commonly fly at rotor height and are the first and fourth most commonly seen raptors on the KPPA, respectively (Table 4.12). The biological impact of turbine-caused mortality on these raptor populations depends on a variety of factors, including the mortality rate at the proposed Wyoming Windplant, and species-specific population dynamics (which are influenced by other factors such as prey availability). There is a lack of accurate information on local golden eagle and ferruginous hawk population structure. Golden eagle populations in the western United States are commonly described as widely distributed and stable (Olendorff 1973, Newton 1979); hence, low turbine-caused mortality rates for this species may not significantly impact the population. However, the ferruginous hawk is a C2 species, indicating there is cause for concern about its population size. Potential impacts of turbine-caused mortality may be greater for this species given the sensitive status of its population. If monitoring of raptor mortality on the KPPA suggests potential negative impacts to raptor populations, detailed studies of raptor population dynamics may be initiated to determine the significance of the impacts (Appendix B).

<u>Alternative A</u>. Alternative A impacts the same area and number of raptor nests as the Proposed Action, but would have 40% fewer turbines. Under Alternative A, potential impacts from violations of federal laws or Windplant-related population declines could be significant, as described for the Proposed Action.

Mortality rates under Alternative A probably would be lower than for the Proposed Action (Table 4.14), but may not be reduced by 40% because factors such as turbine characteristics and placement could influence mortality rates (Howell and Noone 1992; Orloff and Flannery 1992). As with the Proposed Action, the monitoring program would be used to obtain site-specific mortality estimates and identify appropriate mitigation measures for phases subsequent to Phase I.

<u>No Action</u>. Under the No Action Alternative, no impact to raptors due to Windplant development would occur.

<u>Cumulative Impacts</u>. It is generally assumed that regional populations of common raptors are widely distributed and stable (Olendorff 1973; Newton 1979; personal communication, January 1995, with Tamara Holmes, University of Colorado Health Sciences). However, the dynamics of local raptor populations within and around the KPPA are unknown, hence, cumulative impacts are difficult to evaluate, since the potential area of impacts cannot currently be defined. If raptor populations in the area are panmictic, birds may readily disperse throughout southern Wyoming

since there are no obvious physiographic boundaries that would prevent movement of raptors. Raptors displaced by the Windplant could move to other territories if suitable habitat is available. However, existing and proposed developments in the Great Divide and Green River Resource Areas (Map 4.1) could affect availability of suitable habitat. If local raptor populations are being affected by other developments, climatic influences, or other factors, mortality within the KPPA could be additive, and raptor populations may decline over time. Furthermore, the proposed Medicine Bow windfarm would constitute another potential source for direct mortality, as well as displacement. This potential additive effect would be more severe if raptor populations have localized recruitment and movements.

The monitoring program described in Appendix B would be implemented, beginning with the first phase of development, to determine whether actual mortality rates could affect raptor populations. The POD process described in Section 2.1.2 provides BLM with mechanisms for evaluating impacts of each phase and taking the necessary steps to prevent raptor population impacts caused by the Proposed Action or Alternative A. Monitoring would also help define the area of potential cumulative impacts and clarify potential effects of other developments in southern Wyoming on raptor populations. If it is determined that raptor populations are widely distributed, cumulative impacts of the Proposed Action should be viewed on a regional scale and further monitoring of raptor populations would be necessary to determine how much disturbance and displacement local raptor populations can tolerate.

4.2.3.5 Upland Game Birds

Significance Criteria. Impacts to upland game bird (i.e., sage grouse, blue grouse, and mourning dove) populations would be considered significant if project construction and operation contributed to the decline of these populations within the KPPA.

Proposed Action. Approximately 300,000 ac of probable sage grouse nesting habitat occurs in the two HMP areas within which the KPPA occurs (Table 4.10). Construction of Phase I of the Proposed Action would result in the disturbance of 110 ac of probable sage grouse nesting habitat, or 0.04% of this habitat type within the two HMP areas (Table 4.10). Most of this disturbance would be along the transmission line ROW and would virtually disappear following successful reclamation; only about 2 ac of disturbance within probable sage grouse nesting habitat would remain for the LOP. Approximately 1,185 ac of probable nesting habitat (see Section 3.2.2.4, Sage Grouse, for definition) would be disturbed during construction of the 500-MW Windplant, which represents approximately 0.4% of this habitat within the two HMP areas. LOP disturbance within probable nesting habitat would be 471 ac (i.e., 0.2% of this habitat within the two HMP areas). No WTGs would be situated within the 3,115 ac of potential sage grouse breeding habitat on the KPPA. A standard BLM wildlife stipulation prohibits activity or surface disturbance within 0.25 mi (0.40 km) of an existing sage grouse lek center; however, the AO, in consultation with the WGFD, may grant exceptions to this stipulation. It is unlikely that habitat loss and disturbance associated with the Proposed Action would result in a decline in local sage grouse populations (i.e., a significant impact). If sage grouse populations continue to decline in Wyoming (WGFD 1994d), however, the probable nesting habitat loss associated with the 500-MW Windplant could become a significant impact (i.e., especially on a local level).

Yeo et al. (1984) determined that there was no decrease in sage grouse lek attendance due to construction or operation of a large WTG immediately north of the KPPA; variations in lek attendance could not be directly attributed to the presence of the WTG. On the other hand, mining activity at a surface coal mine in North Park, Colorado, contributed to a drop in male sage grouse attendance at leks closest to mining activity and, over time, altered the distribution of breeding grouse (Remington and Braun 1991). Since the

WTGs of the proposed project would not be located within sage grouse breeding habitat, it is unlikely that their presence would result in a significant negative impact to sage grouse populations. However, leks located immediately adjacent to existing roads could experience some disturbance from increased traffic due to project activity.

A slight increase in sage grouse mortality could result from the presence of WTGs and the 230-kV transmission line due to fatal collisions. In Utah, sage grouse collision fatalities were associated with roadside overhead telephone wires (Borell 1939). Several dead sage grouse were found below a section of 230-kV transmission line in Montana, and carcasses evidenced contact trauma (i.e., severe mutilation of necks, wings, breasts, and abdomen) (Myers 1977). Myers (1977) noted that sage grouse fly at heights of 30 to 40 ft (9 to 12 m). Some sage grouse within the KPPA may collide not only with the proposed transmission line, but also with the lower reaches of moving rotors. However, given the relative infrequency of sage grouse flights (i.e., usually limited to escape reactions, movements to foraging areas, short elevational migrations), it is unlikely that these collisions would be numerous or result in a significant impact to sage grouse populations within the KPPA.

Potential changes in snow distribution due to WTGs and downtower structures may influence the amount of winter habitat available to sage grouse on the KPPA. Hupp and Braun (1989) noted that sage grouse in the Gunnison Basin of Colorado favored winter habitat with low snow cover. In winter, areas immediately leeward of WTGs and other structures would develop snow drifts and become unusable to sage grouse. Given the limited area covered by these drifts, however, these changes would likely not result in significant negative impacts to sage grouse populations, but may alter the distribution of wintering birds in the KPPA.

It is unlikely that noise related to the Proposed Action would adversely impact sage grouse reproductive success. Male sage grouse strut, fan their tail feathers, and produce a popping sound by rapidly inflating and deflating air sacs as part of their courtship display to attract females (Scott 1987). The noise generated by the proposed WTGs would, for the most part, not exceed the existing ambient noise level occurring at sage grouse leks within the KPPA (Section 4.1.8.2).

Impacts to mourning dove and blue grouse within the KPPA would likely be negligible. Some doves may collide with WTGs; however, given the low number of mourning doves observed crossing the rim (Mariah 1994a), it is unlikely that these collisions would be numerous enough to negatively impact mourning dove populations within the KPPA. WTGs would not be constructed within potential blue grouse habitat.

Alternative A. Approximately 754 ac of probable sage grouse nesting habitat would be disturbed due to construction of Alternative A (Table 4.10); this is about 36% less initial disturbance than would occur with the construction of the 500-MW Windplant. LOP disturbance under Alternative A would be approximately 282 ac. Impacts to sage grouse populations due to construction and operation of Alternative A would likely be moderate; initial disturbance (i.e., that prior to complete reclamation) could be significant if sage grouse populations within Wyoming continue to decline (WGFD 1994d). Other impacts (e.g., development activity, collision mortality, snow accumulation) would be present, but lower in intensity than described for the 500-MW Windplant.

No Action. No impacts to sage grouse, blue grouse, or mourning dove populations within the KPPA would occur under the No Action Alternative.

Cumulative Impacts. Existing and foreseeable cumulative disturbance (e.g., oil and gas development, surface mining, proposed windpower development, roads) within nesting habitat for sage grouse in the two HMP areas amounts to 22,923 ac, or 7.64% of this habitat type

(Table 4.11). Given the fact that sage grouse populations throughout Wyoming have been declining over the past several years and that this decline is attributed to habitat loss (WGFD 1994d), this level of disturbance should probably be considered a significant impact to populations within HMP areas. Phase I Windplant construction would increase this cumulative disturbance by about 0.05%, which is a negligible additional cumulative impact. Construction of the 500-MW Windplant, however, would increase existing cumulative disturbance to sage grouse nesting habitat by approximately 5.2%; this is likely a significant increase to an already heavily impacted resource (WGFD 1994d).

4.2.3.6 Waterfowl, Shorebirds, and Waders

Significance Criteria. Impacts to waterfowl, shorebirds, and waders would be considered significant if mortalities resulted in declining populations or violations of the MBTA and ESA as discussed in Section 4.2.3.3.

Proposed Action. There is potential for direct (i.e., mortality) and indirect (e.g., habitat displacement) impacts on waterfowl, shorebirds, and waders due to Windplant development. Both direct and indirect impacts are potentially significant. At Windplants in the U.S. (Montezuma Hills), only one waterfowl mortality (mallard), has been recorded (Howell and Noone 1992). No shorebird or wader mortality has been recorded at any Windplant in the U.S. At a single large turbine located on the coast of Denmark, three water bird carcasses (a gull, a duck, and a coot) were recovered during a two-year study (Pedersen and Poulsen 1991). However, no mortality was observed during a survey of mid-sized turbines [33-98 ft (10-30 m) towers, 23-82 ft (7-25 m) rotors] along the coast of the Netherlands (Winkelman 1985). Most researchers have concluded that turbine-caused mortality is not biologically significant for these species, based on low mortality rates and presumed large populations (Howell and DiDonato 1991, Howell et. al 1991b, Orloff and Flannery 1992). However, the absence of carcass recovery may reflect problems with sampling design or searcher efficiency and not the absence of Windplant mortalities.

The proposed Windplant would be the first industrial scale windpower facility in Wyoming; hence, no regionally specific data on potential waterfowl, shorebird, and wader mortality are available. No regional data are available for population structures of these groups within the KPPA, so potential population impacts are based on speculation. The KPPA provides little nesting or foraging habitat for these species, and their use of the area is primarily incidental or during migration; therefore, impacts would probably not be significant. However, mountain plover, a candidate species for federal T&E listing, nest on top of Foote Creek Rim where turbines would be placed. Adult mountain plovers and their chicks were frequently seen on the rim during the 1994 breeding season (Mariah 1994a). Section 4.2.4.3 includes a discussion of potential impacts of the proposed project on the mountain plover.

The flight behavior of waterfowl, shorebirds, and waders may make them susceptible to collisions with turbines. Many flight observations (45%) of these species were at rotor height (Section 3.2.2.5). However, on Foote Creek Rim, waterfowl and shorebird [except mountain plover (Sections 3.2.3.2 and 4.2.4.3)] use of the rim is limited to infrequent flyovers (less than 5% of non-raptor observations were of these types) (Mariah 1994a). The relationship between abundance, use and turbine-caused mortality has not been quantified for waterfowl and shorebirds, so impacts of the proposed development cannot be definitively stated. However, given the very low mortality of waterfowl and shorebirds at other Windplants, it is unlikely that common species will suffer biologically significant mortality.

The 230-kV transmission line and overhead collection and communications lines could also cause waterfowl, shorebird, and wader mortality within the Windplant. Estimated annual mortality rates (including passerines) from collisions with power lines for other parts of the U.S. range from 1.6 mortalities/mi (1.0 per km) of overhead wire

(Illinois) (Avery 1979) to 106 birds/mi (66.0/km) of power line during fall migration (Great Plains) (Faanes 1987). However, in the latter study, the estimated annual mortality rate doubled after accounting for scavenger removal of carcasses and observer error in locating carcasses. Goddard (1977) reported 54.0 mortalities/mi/year (33.6 mortalities/km/year) in Minnesota during spring and fall. Lower rates have been observed in central Michigan (<0.01 collision/year for gulls, 0.4 collision/year for blue-winged teal, 0.1 collision/year for American coot, and 20.5 collisions/year for great blue heron).

In the U.S., mortality of over 80 species of birds has been documented due to wire strikes or electrocutions. Migratory water birds such as grebes, pelicans, herons, ducks, cranes, and shorebirds were most frequently killed. Attractive habitat, weather, visibility, and flight behavior are among the factors affecting mortality (Table 4.16). Overhead ground wires apparently cause more mortality than overhead conductors, probably because ground wires are typically thinner and less visible than conductors (Beaulaurier et al. 1984; Faanes 1987; Lee 1978). In studies of power line avian mortality, 80 to 95% of deaths were attributed to collisions with overhead ground wires (Beaulaurier et al. 1984; Faanes 1987), and ground wire removal reduced mortality by approximately 50% (Beaulaurier et al. 1984). Since ground wire removal or burial is generally not feasible, ground wires may be marked (e.g., balls, spiral vibration dampeners) to improve visibility and reduce impacts to waterfowl, shorebirds, and waders. Although many waterbird species have been observed within or immediately adjacent to the KPPA, no mortality would occur due to electrocution because conductors would be spaced to prevent electrocution. Furthermore, preferred habitat for waterbirds is limited within the KPPA and is primarily restricted to riparian areas, which make up <1% of KPPA (Section 3.2.1.2).

Impacts due to power line collision would be mitigated by locating lines away from riparian areas or known foraging or nesting areas for these types of birds. Small wetlands within the KPPA would be avoided, where feasible. Impacts probably would be greatest where the 230-kV transmission line crosses the Medicine Bow River; all three alternate routes would cross the river, but the riparian area is much wider where Alternate 1 crosses compared with Alternates 2 or 3.

Indirect impacts (i.e., loss of foraging or nesting habitat, displacement) would be negligible because little habitat for waterfowl, shorebirds, and wading birds occurs within the KPPA.

Under the Proposed Action, waterfowl, shorebird, and wader mortality would probably be relatively low due to their low numbers and incidental use of the KPPA. Mortality is unlikely to have a significant effect on populations, unless individuals of T&E species are killed. Impacts on T&E bird species are discussed in Section 4.2.4.3. Waterfowl, shorebird, and wader mortality would be monitored beginning with the first phase of development (Appendix B), and appropriate mitigations would be developed and incorporated into PODs for subsequent phases as impacts on these groups are understood.

<u>Alternative A</u>. Under Alternative A, 40% fewer turbines and overhead collection and communications lines would be erected, and thus, potential for collisions with turbines would be reduced, although the amount of reduction would depend on turbine placement relative to flyways and foraging and nesting areas. Direct and indirect impacts are potentially significant. However, due to the low numbers of water birds using the KPPA, negligible LOP impacts to waterfowl, shorebird, or wader populations are expected (except see Section 4.2.4.3). Impacts due to transmission line construction would be the same as for the Proposed Action, and similar mitigation measures (i.e., locating the transmission line away from wetlands and riparian areas; marking overhead ground wires, where necessary), would be implemented. Mortality of these species would be monitored beginning with the first phase of development to further assess impacts and

Table 4.16 Factors that May Influence the Number of Bird Collisions with Transmission Lines.[1]

Bird biology	Factors Influencing Collisions
Species	Nocturnal fliers or those with awkward flight characteristics
Age	Immature birds with limited flight experience
Health	Sick or injured birds
Migration	Migrants, as opposed to resident birds
Sex	Birds involved in courtship displays
Flight	
Flight intensity	Large numbers of birds crossing the ROW during all times of day
Flight height	Flight heights equal to or lower than the uppermost wires
Size of flocks	Large dense flocks with little space between birds
Time of flocks	Nocturnal and diurnal flights during inclement weather
Transmission line	
Tower type	Guyed structures or tall towers near river crossings
Voltage	Lower voltage lines with reduced electric field and corona effects
Conductor characteristics	Small diameter, single conductor/phase configurations
Number of lines	Double-circuit lines with wire at different heights
Overhead ground wire	Multiple wires small in diameter compared with conductors
Line length	A long line through a high-use area
Age of line	A newly constructed line to which birds have not habituated
Aircraft warning light	Nonflashing lights on towers in established flyways
Environment	
Weather	Fog, snow, rain, sleet, or high winds
Habitat	Attractive bird habitat on and surrounding the ROW
Human activity	Hunting and other human activities that startle or distract birds; other developments in adjacent areas that may displace birds onto proposed site
Geographic location	Lines located perpendicular to a narrow, low-altitude flyway

[1] From Lee (1978).

develop appropriate mitigation measures for subsequent phases.

No Action. Under the No Action Alternative, no impact to waterfowl, shorebirds, or waders would occur due to Windplant development.

Cumulative Impacts. Cumulative impacts to waterfowl, shorebirds, and waders probably would be greatest during migration seasons when large numbers of migrating birds encounter power lines or other developments in flyways. Power lines near riparian areas would cause the greatest mortality because these types of birds would be taking off, landing, and concentrating in these areas. Because there is little riparian habitat within southern Wyoming, individual wetlands may be an important oasis for migrating birds. There are currently few power lines crossing waterways (e.g., the North Platte and Green Rivers, Seminoe Reservoir), so migrating or resident birds would have sufficient alternate suitable habitat, if power lines across waterways on the KPPA made this habitat unsuitable. Alternatively, placement of power lines across waterways may not cause water birds to avoid these areas, and continued use may increase avian mortality due to collisions with power lines.

Other types of development (e.g., oil and gas, coal, urban) probably cause some mortality and displacement of waterfowl, shorebirds, and waders. Because local population dynamics are not known, cumulative impacts from these developments cannot be definitely quantified. Cumulative impacts (direct and indirect) probably would be negligible due to the lack of extensive waterfowl, shorebird, and wader concentration areas among these developments.

4.2.3.7 Passerines

Significance Criteria. Impacts to passerines would be considered significant if project-related activities resulted in violation of the MBTA (16 U.S.C. 703-711) or declining passerine populations.

Proposed Action. The primary impact to passerines under the Proposed Action would be turbine-caused mortality. Indirect impacts (e.g., displacement, loss of habitat) also could lead to population declines; therefore, impacts to passerines are potentially significant.

Passerine mortality has occurred at Windplants in the U.S. and abroad. At a single large turbine located on the coast of Denmark, seven non-raptor carcasses (including passerines and waterfowl) were recovered during a two-year study (Pedersen and Poulsen 1991), and no mortality was observed during a survey of mid-sized turbines [33-98 ft (10-30 m) towers, 23-82 ft (7-25 m) rotors] (Winkelman 1985). Numbers of passerines recovered annually from Windplants in California ranged from 1 to 26, with the most (26) recovered at Altamont Pass, where 1,169 turbines were sampled (Howell and Noone 1992, Orloff and Flannery 1992). However, the California studies concentrated on raptor mortality, and may have missed small passerine carcasses. Twenty-five passerine carcasses were recovered from the two turbines at Medicine Bow, Wyoming (Yeo et al. 1984). Avian collisions with man-made structures account for an estimated 5 to 80 million mortalities annually (Avery 1979, Jaroslow 1979). Most deaths are caused by collisions with vehicles, overhead power lines, towers, and other tall structures (Avery 1979, Banks 1979, Cassel et al. 1979, Beaulaurier et al. 1984, Faanes 1987).

Many researchers have concluded that turbine-caused mortality for passerines is not biologically significant, based on low passerine mortality rates and presumed large passerine populations (Howell and DiDonato 1991, Howell et. al 1991b, Orloff and Flannery 1992). However, passerine carcasses are difficult to locate during mortality surveys due to their small size and other factors (e.g., scavenging by predators, searcher efficiency, etc.); therefore, passerine mortality may be greater than reported.

Potential passerine mortality is difficult to quantify because the proposed Windplant would be the first industrial scale windpower facility in Wyoming.

Furthermore, passerine population status within the KPPA is unknown, so speculation about potential impacts to passerines must be based on regional Breeding Bird Survey data. Breeding Bird Survey data have several limitations that make speculation about passerine population trends tenuous. The biggest limitation is that point counts are conducted along roads, so rare birds and birds of locally distributed habitats poorly represented by roads are undersampled (Robbins et al. 1993). The horned lark was, by far, the most commonly seen passerine within the KPPA (Mariah 1994a), and this species is listed as an abundant resident throughout southern Wyoming (WGFD 1992). However, according to Breeding Bird Survey data compiled by the USFWS, horned lark populations have experienced significant declines in the western U.S., as well as in Wyoming, for the past two decades (Cerovski et al. 1993). Horned lark numbers have also been declining in the Wyoming Basin, the physiographic region where the proposed Windplant is located, but the decrease has not been significant (Cerovski et al. 1993).

The five other most commonly seen passerines within the KPPA in order of abundance were the mountain bluebird, cliff swallow, Brewer's blackbird, vesper sparrow, and green-tailed towhee (Section 3.2.2.6) (Mariah 1994a). Cerovski et al. (1993) reported that cliff swallow populations have been increasing in the western U.S., Wyoming, and the Wyoming Basin. The Brewer's blackbird population has remained relatively stable, experiencing a slight decrease in the Wyoming Basin. Green-tailed towhee populations slightly increased in the state, while they decreased 9.5% (a non-significant decline) in the Wyoming Basin. Vesper sparrow numbers decreased in Wyoming in the last ten years, but significantly increased (8.4%) in the Wyoming Basin. Finally, the mountain bluebird experienced a slight decrease in population size in Wyoming in the last ten years, but numbers significantly increased (7.6%) in the Wyoming Basin (Cerovski et al. 1993). Population trends for western neotropical migrants were also reported for Wyoming in Carter and Barker (1993). Their conclusions are comparable to Cerovski et al. (1993): horned lark populations are declining, cliff swallow, mountain bluebird, and vesper sparrow populations are increasing, and there are not enough data to determine the population trend for the Brewer's blackbird or green-tailed towhee.

Given the large number of passerines seen on the KPPA in 1994 (over 9,000 passerine observations recorded during seven months of weekly surveys on Foote Creek Rim) (Mariah 1994a), passerine mortality is likely to occur under the Proposed Action, although turbine-caused mortality rates are unknown for any one species. Because any mortality would be a violation of the MBTA (unless limited take is permitted by the USFWS), the impact would be significant. Mortalities may be reduced by avoiding placement of WTGs in high use areas (Figure 3.4). Flight behavior of passerines would also probably lead to a lower turbine-caused mortality for these species compared to raptors or waterfowl. A small percentage (11-16%) of passerines were observed flying at rotor height on Foote Creek Rim; most were observed flying below rotor height (Table 3.17). However, passerines may fly higher during migration, and mortality rates may temporarily increase during spring and fall (personal communication, November 1994, with Linda Kerley, University of Wyoming Cooperative Unit).

If turbine-caused passerine mortality rates are low, the impacts to passerine populations probably would not be biologically significant. Although precise passerine population data are lacking, broad-based regional data suggest the most commonly seen passerines, with the exception of horned larks, within the KPPA generally have healthy populations; if current trends continue, impacts to most populations would probably be negligible for the LOP. While horned larks seem abundant, populations have been declining for the last 20 years (Cerovski et al. 1993), and additive mortality caused by wind turbines could lead to further population decline, which would be a significant impact. Passerine mortality would be monitored beginning with the first phase of development (Appendix B), and appropriate

mitigations would be developed and incorporated into PODs for subsequent phases as impacts to passerine populations are understood.

In addition to mortality caused by turbines, the 230-kV transmission line and overhead collection and communications lines could also cause passerine mortality within the KPPA (see Section 4.2.3.6 for a discussion of avian deaths caused by electrocution and potential impacts to populations).

Under the Proposed Action, impacts to passerines would be significant because the MBTA would be violated when passerines are killed by collisions with turbines, unless a special purpose permit or other authorization is obtained from the USFWS. Impacts to horned larks would be potentially significant. Probability of turbine collision is low for passerines because most of these species were observed flying below turbine rotor height. Therefore, although Brewer's blackbird and green-tailed towhee populations are declining regionally, impacts to these populations would probably be negligible.

Alternative A. Under Alternative A, impacts to passerines would be potentially significant. Alternative A impacts the same area as the Proposed Action, but would have 40% fewer turbines. Impacts to passerines under Alternative A probably would be less, but may not be reduced by 40% because factors such as turbine characteristics and placement would influence mortality rates. As with the Proposed Action, the monitoring program would measure passerine mortality and identify appropriate mitigation measures.

No Action. Under the No Action Alternative, no impact to passerines due to Windplant development would occur.

Cumulative Impacts. Lack of data quantifying the status of local passerine populations and impacts of other disturbances in the area make assessment of cumulative impacts tenuous. However, most common species sampled with Breeding Bird Survey techniques appear to have stable or increasing populations (Cervoski et al. 1993). The population trends of uncommon or rare passerines remain unknown. Although collision probabilities are not known for Wyoming, low mortality rates comparable to those recorded at other Windplants are anticipated for the Proposed Action. Given large regional passerine populations (Cervoski et al. 1993) and anticipated low collision rates, cumulative impacts of the Proposed Action are not expected to be biologically significant. Horned lark populations may be significantly impacted over time if this species has high turbine-caused mortality that contributes to additional decline in an already declining population. Mortality rates of horned larks and all passerines will be monitored to determine the significance of impacts of the Proposed Action to passerine populations. During monitoring, cumulative impacts of the Proposed Action would be viewed on a regional scale for passerine populations, if necessary.

4.2.3.8 Amphibians and Reptiles

Significance Criteria. Quantifiable criteria that specifically define that level at which disturbance to amphibian and reptile habitats becomes a significant impact to population health are not described in the literature or by regulatory agencies. For this EIS, impacts to amphibian and reptiles would be considered significant if project activities result in a decline in populations of these species.

Proposed Action. While amphibians and reptiles would be negatively affected by increased human activity in the KPPA, primary effects would occur in direct proportion to the amount of potential habitat removed by project construction. Approximately 319 ac of potential habitat would be disturbed due to Phase I construction, which represents approximately 0.5% of potential habitat within the KPPA. Construction of the 500-MW Windplant would disturb approximately 1,787 ac of potential amphibian and reptile habitat, or about 3% of the KPPA. Overall impacts to amphibian and reptile populations within the KPPA would likely be negligible due to the relatively low density of amphibian and reptile species within the

KPPA combined with the scattered distribution and extent of potential disturbance. Rare or important habitats (e.g., wetlands) would be avoided during Windplant construction, further reducing impacts to amphibian populations in the KPPA. A slight increase in amphibian and reptile mortality would initially occur due to Phase I and the 500-MW Windplant construction, and would remain slightly elevated for the LOP due to increased traffic; this impact to populations would also be negligible.

Alternative A. Impacts to habitats used by amphibians and reptiles under this alternative would decrease by about 40% from levels identified for the Proposed Action. Therefore, impact levels would likely remain negligible.

No Action. No impact would occur to amphibian and reptile populations within the KPPA under the No Action Alternative.

Cumulative Impacts. Regional cumulative impacts to amphibian and reptile habitat include mines (i.e., approximately 22,598 ac of disturbance, 5,741 ac of which is active at any one time), oil and gas development, and roads (e.g., federal and state highways, primary and secondary roads). The majority of this disturbance is scattered throughout the region, and presents a negligible impact to amphibian and reptile populations. Maximum cumulative disturbance within the KPPA (i.e., construction of the 500-MW Windplant and existing disturbance) would total 2,226 ac, or 3.7% of the potential amphibian and reptile habitat within the KPPA. With the avoidance of wetlands during Windplant construction and other habitat protection measures (see Section 5.1.3.10), cumulative impacts to amphibian and reptile populations within the region are expected to be negligible.

4.2.3.9 Fisheries

Significance Criteria. Impacts to fisheries would be considered significant if project-related activities resulted in the degradation of any surface water such that its WGFD Stream Classification (WGFD 1991) would be permanently reduced.

Proposed Action. Although unlikely, initial construction activities may degrade water quality due to increased sedimentation and runoff. This potential impact probably would be negligible with the implementation of proper erosion control mitigations (see Sections 5.1.3.6-5.1.3.7) and would remain negligible throughout the LOP. In addition, the distance of disturbance from fisheries and avoidance of wetland areas would further minimize potential fisheries impacts.

Alternative A. Since the total area of disturbance would be less than that for the 500-MW Windplant and the same mitigation measures would be applied, impacts to fisheries under Alternative A would likely remain negligible for the LOP.

No Action. No additional impacts beyond existing levels would occur to fisheries under the No Action Alternative, since no additional development would occur.

Cumulative Impacts. Since all regional development projects (e.g., oil and gas development, surface mines) seek to employ proper erosion control and construction techniques, cumulative impacts to fisheries would likely be moderate. Some water quality degradation may occur as a result of water runoff from such large-scale disturbances as surface mines; however, mines employ sediment control structures to reduce potential impacts to water quality.

4.2.4 Threatened/Endangered, Candidate, and State Sensitive Species

4.2.4.1 Significance Criteria

Impacts to TEC&S species would be significant if: 1) any individual was taken (see Section 4.2.3.3 for details); and/or 2) their critical habitat was disturbed or destroyed such that the likelihood of survival or recovery of the species would be appreciably reduced.

4.2.4.2 Mammals

Black-footed Ferret. No significant adverse impact to the BBF is anticipated due to the proposed project because of the current lack of ferret populations in the KPPA and the limited amount of prairie dog colonies that would be disturbed by the construction of the Windplant and transmission lines. If BBFs are discovered in the KPPA, the USFWS, WGFD, and BLM would be consulted to determine the specific procedures necessary to protect the animals under the guidelines established for the reintroduced experimental population. BBF clearance surveys may be conducted [according to guidelines presented in USFWS (1989)] if BBFs are discovered within the KPPA and if sufficient potential ferret habitat would be disturbed in subsequent phases of the project. The BBF is the only federally designated T&E mammal for which potential habitat is present, or which has been reported, in or near the KPPA. The KPPA is within the area declared ferret-free prior to the reintroduction of ferrets in the Shirley Basin, and no ferret sightings have been confirmed in the KPPA since the reintroduction. It is unlikely that BBFs are currently present, but prairie dog colonies occurring throughout the KPPA provide potential habitat for the species.

Approximately 35% of the Simpson Ridge area is classified as BBF PMZ 2. Movements outside of the Shirley Basin PMZ 1 reintroduction site are anticipated as the ferrets become established and disperse. Three historic prairie dog colonies encompass approximately 979 ac (20%) (only a portion of which was active in 1994) of the Foote Creek Rim area and approximately 6.0 mi (9.7 km) of historic prairie dog colonies are crossed by Alternate 3. Alternates 1 and 2 also cross prairie dog colonies, the extent of which has not been field mapped. Approximately 34 ac of prairie dog colony will be disturbed by roads and WTGs on the Foote Creek Rim area. The amount of prairie dog colony that will be disturbed in the Simpson Ridge area will depend on the number of WTGs and roads that would be placed in prairie dog colonies, which has not been determined at this time. The transmission line will cross prairie dog colonies, but the surface will not be bladed, staging areas will be placed outside of prairie dog colonies, and the only subsurface disturbance will be the holes dug for the poles. Antiperching devices for raptors will be installed on transmission line poles within prairie dog colonies in the PMZ to eliminate perching opportunities for raptors that might prey on BBFs.

Alternative A would have no significant adverse impact to the BBF due to the same reasons given above for the Proposed Action. There would be 40% less area disturbed under Alternative A, which may decrease the potential for disturbing prairie dog colonies; however, the disturbance locations on the Simpson Ridge area have not been determined and it is likely that the reduced number of WTGs would reduce prairie dog colony disturbance by something other than 40%, depending on WTG placement. The No Action Alternative would have no impact on the BBF. The proposed project would have only negligible additional impacts, if any, to the cumulative effects on BBF habitat from ranching, mining, oil and gas projects, and transportation; and on prairie dogs from pest control and recreational shooting.

Other Mammals. Of the three C2 mammals that are of concern, both the long-legged myotis and the swift fox are provided with potential habitat on the KPPA. Potential habitat for the North American lynx is not present on the KPPA, and this mammal may occur only very rarely within the area (i.e., vagrant individuals). Therefore the lynx would not be impacted by the proposed project or alternatives. Long-legged myotis have not been observed within the KPPA, but are potential visitors to the area. The foraging flights of this species are direct and rapid, and often at treetop height (Clark and Stromberg 1987); therefore, these bats could be subject to turbine mortality. Overall, however, the likelihood of collision is probably slight, and the species would not be adversely impacted by Windplant development.

Swift fox have not been reported in the KPPA, but grassland habitats within the area could be used by the species. Disturbance of grassland types would reduce potential habitat; however, impacts of the proposed project or Alternative A would be negligible due to this species' infrequent use of the area.

The state sensitive mammals that have been reported near, but not in, the areas proposed for WTGs are white-footed mouse and hoary bat. White-footed mice inhabit deciduous woodlands and associated riparian areas, and the only disturbance in those habitats would be associated with the transmission line. Transmission line disturbance will be minimized in these habitats, and impacts to the white-footed mouse, if they occur at all, are expected to be negligible. Hoary bats may occur in the KPPA during the summer, and the potential for them to collide with turbine rotors is present; the probability of such collisions is unknown, but anticipated to be low given the bat's ability to locate and respond to both stationary and moving objects. Hoary bat populations are secure globally (WNDD 1991), and any impacts of the proposed project or alternatives are expected to be negligible.

Overall, the Proposed Action or Alternative A would be expected to cause negligible additions to the cumulative effects on these candidate and state sensitive species from ranching, mining, oil and gas projects, transportation, and recreational activities in the region.

4.2.4.3 Birds

Endangered Species

Of the three endangered bird species identified as potentially present in the project area by the USFWS, two (bald eagle and peregrine falcon) have been observed. Whooping cranes could incidentally migrate through the KPPA, but none have been reported, and the KPPA is outside of the area they normally use during migration. Therefore, the Proposed Action and alternatives are not expected to have any impact on whooping cranes.

Bald Eagle. No bald eagle nests were located within the KPPA during the 1994 nest survey; however, one active nest was located approximately 2.0 mi (3.2 km) south of the Simpson Ridge area, and bald eagles have been observed using both the Foote Creek Rim and Simpson areas (Section 3.2.3.2). No specific winter roost sites have been identified within or immediately adjacent to the KPPA, but cottonwood trees along the Medicine Bow River, Rock Creek, and other drainages are regularly used as perches. Because there is potential for bald eagle mortality, impacts from Windplant development under the Proposed Action or Alternative A are potentially significant.

Bald eagles react to human disturbance by flying away from the source of disturbance and avoiding areas of intense human activity (Vian 1971, Stalmaster and Newman 1978, Steenhof 1978). The closest distance that bald eagles will tolerate human activities is variable and depends on numerous factors, including age, presence of food, and habituation to activity. Bald eagles appear to habituate to routine human activity (Edwards 1969, Grier 1969, Stalmaster and Newman 1978). Stalmaster and Newman (1978) report that buffer zones of 820 ft (250 m) would protect 99% of the wintering bald eagle population from disturbance in open regions where human activities are common. When there is no human activity, bald eagles readily approach man-made structures (Vian 1971). An initial surface disturbance of 319 ac during Phase I and 1,787 ac for the 500-MW Windplant (715 ac for the LOP) combined with the presence of facilities and humans will reduce the amount of foraging habitat available to bald eagles. These birds forage widely during winter and seek concentrated food sources (e.g., fisheries and waterfowl conservation areas) and areas with high lagomorph populations. They are opportunistic scavengers of domestic livestock and big game carcasses. The KPPA has not been identified as critical habitat for the bald eagle. The amount of foraging habitat disturbed by the

proposed project or Alternative A (approximately 40% less) would likely have a negligible adverse impact on prey and foraging opportunities available to bald eagles using the KPPA and surrounding region.

Mortality or injury is the primary potential impact on bald eagles that may occur as a result of the proposed project. Bald eagle mortality has been reported from both electrocution and impacts with power lines (Coon et. al. 1970, Vian 1971). Mortality through electrocution is not expected to be a problem with the proposed project because the overhead collection and transmission lines will be designed and constructed as recommended in Olendorff et al. (1981) and wildlife boots will be placed on other electrical facilities to reduce the chances of electrocution. Instead, mortality or injury will more likely be due to collisions with either power lines or WTGs. Although bald eagles were observed on windfarms in California, no bald eagle carcasses have been recovered from these windfarms (Howell and Noone 1992, Orloff and Flannery 1992). Hence, data on which to base a quantitative estimate of numbers of bald eagles killed on the KPPA (i.e., similar to estimates given for some other raptor species in Section 4.2.3.4) is lacking. However, given the year-round presence of bald eagles of all age classes in the KPPA, combined with the number of WTGs and amount of new power line, mortality due to collision is likely during the LOP. Mortality of even one bald eagle would be a significant adverse impact. If annual bald eagle mortality were equivalent to the estimated mortality of 3 to 15 golden eagles (which are much more abundant than bald eagles on the KPPA), there would be a significant adverse impact to the population of bald eagles using the KPPA. Bald eagle mortality will be monitored to determine the number killed, if any.

The No Action Alternative would have no impact on bald eagles.

Cumulative impacts to the regional bald eagle population may be potentially significant. Impacts resulting from such developments as surface mining, oil and gas development, urban developments, and roads are generally negligible; some foraging habitat is removed, but large areas remain available to eagles. Also, all developments (including the proposed Windplant) avoid winter roosts and active nests, further minimizing disturbance to the species. Direct mortality resulting from WTGs on the proposed Windplant would present the largest source of impact to the regional bald eagle population; the significance of this impact is dependent upon the number of actual collision mortalities occurring over the LOP.

Peregrine Falcon. No peregrine falcon nests were located on or near the KPPA in 1994, and there is a minimal amount of suitable nesting habitat (i.e., tall cliffs) available in the area. Therefore, neither the Proposed Action or the alternatives are likely to impact peregrine falcon nesting or breeding activity. Peregrine falcons have occasionally been observed in the KPPA (Section 3.2.3.2), so there is the potential of adverse impacts due to disturbance of foraging habitat or mortality in a manner similar to that described for bald eagles. Although peregrines may be relatively sensitive to human presence, they exhibit wide variation in their response to humans, with some even residing and nesting in major metropolitan areas. The impact due to habitat loss through removal of vegetation and human presence would be negligible given the occasional use of the area by peregrine falcons and the presence of other large, undisturbed areas that will remain within the KPPA and surrounding region. As with bald eagles, mortality due to electrocution is unlikely; there is, however, the potential for mortality due to collisions. Falcons may be more susceptible to collisions than bald eagles due to their hunting behavior. Twenty-one of 27 (78%) peregrine falcons observed in the Foote Creek Rim area during 1994 surveys were flying within the range of the rotor blades [i.e., 26-184 ft (8-56 m)] (Mariah 1994a). In addition, falcons focus on flying prey and may not pay attention to potential hazards in the vicinity of the hunt. As was discussed previously for other raptors (including bald eagles), it is difficult to estimate the amount of mortality that may take place due to the

Proposed Action or Alternative A; however, any mortality of peregrine falcons would be a significant impact due to the endangered status of the species.

The No Action Alternative would have no impact on peregrine falcons.

Cumulative impacts to the regional peregrine falcon population would be similar to that described for the bald eagle (i.e., potentially significant). The proposed Windplant may be the largest source of direct mortality to peregrine falcons in the area; any mortality to this species would be considered a significant impact.

Candidate Species

Bird species that are candidates for T&E listing and have the highest potential to be impacted by the proposed project are mountain plover, ferruginous hawk, and loggerhead shrike; each is discussed below. Other candidate species known to occur or potentially occurring on or adjacent to the KPPA (i.e., Baird's sparrow, long-billed curlew, northern goshawk, western burrowing owl, western snowy plover, trumpeter swan, and white-faced ibis) have only been infrequently reported, and impacts to these species due to the proposed project are expected to be negligible. While the presence of WTGs and transmission lines in areas where these candidate bird species may occasionally fly creates a risk for collision mortality, the probability of such mortality is very low due to the infrequency of these flights through the area.

Given the safeguards that will be built in to the proposed project to prevent electrocution, impacts due to electrocution mortality probably would be negligible and are not discussed individually below. Potential impacts on candidate species within the KPPA are habitat loss due to disturbance and human presence and turbine collision mortality.

<u>Mountain Plover</u>. Mountain plovers were routinely reported (234 observations) on Foote Creek Rim during spring and summer in 1994 (Mariah 1994a). Mountain plovers also nest on the rim; one nest was discovered, and most observations in mid-summer were of adults with chicks. A rough estimate indicates that from 15 to 20 breeding pairs were present on the portion of Foote Creek Rim surveyed during 1994 (see Figure 3.4 for survey point locations). Because loss of mountain plover breeding habitat may be one of the causes for population declines, impacts to mountain plovers from the first phase of development and any future development on the Foote Creek Rim area probably would be significant. Mountain plovers were not recorded in the Simpson Ridge area, but potential habitat is present and 1994 Simpson Ridge surveys were limited to points along Highway 72 and several unimproved roads (Appendix A). Impacts from development on the Simpson Ridge area are potentially significant.

Mountain plover mortality due to collisions with WTG towers or rotors is a potential impact, but the low flight behavior characteristic of the species will likely reduce opportunities to collide with the rotors. Other than during migration, only during breeding and nesting periods do mountain plovers fly more than a few feet off the ground (Graul 1975; Terres 1980). In the "falling leaf" courtship display as described by Graul (1973), male (and occasionally female) mountain plovers fly to a height of 15 to 30 ft (5 to 9 m), hold their wings in a deep "V" position, and float slowly to the ground. The lower reaches of the turbine rotors and the upper limits of the courtship display overlap for a few feet. Approximately 3 of 13 (23%) mountain plover flight heights observed on Foote Creek Rim during 1994 were recorded within the range of the rotor blades [i.e., 26-184 ft (8-56 m)]. Although there is only a limited potential for mountain plover mortality, any mortality of this rare species would be considered significant.

Loss of mountain plover breeding habitat will occur due to disturbance of vegetation and presence of humans. Loss of habitat in the breeding range is suspected as one of the primary

causes for long-term population declines (Wiens and Dyer 1975). Studies and survey data show the mountain plover to be generally tolerant of disturbance, and a radius of disturbance from human activity of 656 ft (200 m) was established based on data from Colorado in 1992 and input from mountain plover researchers (USFS 1994b). Incubation and brooding, which takes place between April and July, are critical periods when disturbance can adversely impact mountain plovers. A bird off the nest for more than an estimated 15 min during incubation, or separated from young for more than 15 min during brooding, may result in the egg not hatching or death of chicks, especially during temperature extremes (USFS 1994b). Using the 656-ft (200-m) distance from human activity as an estimate of reduced habitat effectiveness, potential nesting habitat lost on the Foote Creek Rim area during Phase I would be approximately 1,229 ac (25% of the Foote Creek Rim area) initially and 1,032 ac (21%) for the LOP; full development of the rim would impact approximately 3,241 ac (65%) initially and 3,022 ac (60%) for the LOP. This loss of habitat may be even greater if snowdrifts caused by Windplant facilities persist throughout the spring, when mountain plovers return to the rim and start breeding.

Potential mountain plover habitat on the Simpson Ridge area is less common than on Foote Creek Rim. Although the locations of disturbance within the Simpson Ridge area are not currently known, it is unlikely that all disturbed areas will be potential habitat. In a worst-case scenario for the 500-MW Windplant (i.e., that all disturbance would occur in mountain plover habitat), approximately 8,178 ac (14% of the KPPA) would be initially impacted and 7,654 ac (13%) would remain impacted for the LOP. Figures for Alternative A would reduce this to approximately 4,907 ac (8%) initially and 4,592 ac (8%) for the LOP.

Given the number of mountain plovers that use Foote Creek Rim, the amount of suitable nesting habitat that may be rendered unusable due to project activities, and the fact that the species will very likely be listed as threatened or endangered in the near future, impacts due to the reduction in habitat on the Foote Creek Rim area would be considered significant. The worst case for full development on Simpson Ridge would also be a significant impact; however, this worst-case scenario is not likely, and potential impacts may be reduced to moderate levels given the likelihood that much of the Windplant will be placed on sites that are not potential habitat for mountain plovers.

The No Action Alternative would have no impact on the mountain plover.

Cumulative impacts to the local mountain plover population would be potentially significant. Disturbance due to surface mining, oil and gas development, urban developments, and roads has removed an unknown portion of potential mountain plover nesting habitat. Additional disturbance associated with human activity in and around these sites has increased the overall area affected by these developments. Therefore, existing past and present disturbance within the region surrounding the KPPA may already constitute a significant impact to the local mountain plover population. Surface disturbance resulting from proposed WTGs and roads along Foote Creek Rim would add to this existing, potentially significant loss of mountain plover nesting habitat.

<u>Ferruginous Hawk</u>. Ferruginous hawks are common in the KPPA and frequently fly along the western edge of Foote Creek Rim (Section 3.2.3.2). Seventeen of the 97 ferruginous hawk nests in the 1994 raptor nest survey area were active during 1994. Avoiding physical disturbance of nests or nest substrates, as well as adherence to stipulations prohibiting disturbance of active nests and associated buffer zones, would ensure that only negligible impacts to ferruginous hawk nesting habitat result from the Proposed Action. As is the case with other raptor species within the KPPA, the primary impacts to ferruginous hawks would be habitat disturbance in foraging areas, human presence, and mortality due

to collisions; all of these impacts are potentially significant.

The entire KPPA is potential foraging habitat for ferruginous hawks. Surface disturbance and presence of facilities on the Foote Creek Rim area during Phase I would initially remove approximately 319 ac (68 ac for the LOP); development of the 500-MW Windplant would initially affect 1,787 ac (715 ac for the LOP). The amount of habitat disturbed under Alternative A would be approximately 40% less. Ferruginous hawks avoid areas in close proximity to human activity; the presence workers will temporarily reduce the availability of adjacent foraging habitat on a localized basis. Ferruginous hawks do not avoid areas immediately adjacent to man-made structures if humans are not present, and even build nests on active oil or gas field facilities in the region (personal communication, January 1992, with Bob Tigner, Planning and Environmental Specialist, BLM). The relatively small amount of area disturbed by the Proposed Action or Alternative A would not be a significant adverse impact on ferruginous hawks given the amount of undisturbed habitat available throughout and adjacent to the KPPA.

Mortality due to collisions with WTGs is the most likely potential impact on ferruginous hawks. Based on mortality rates reported from California, estimated ferruginous hawk mortality would be approximately 0.201 birds per year for Phase I and 1.390 birds per year for the full project (Section 4.2.3.4). This mortality estimate may be low given the differences in ferruginous hawk abundance and seasonal use between California and Wyoming (Section 4.2.3.4). On the other hand, use of tubular towers reduces raptor perching opportunities, so ferruginous hawks may not be as likely to be in close proximity to rotor blades in the Wyoming Windplant (i.e., mortality due to collisions may be reduced). Although not currently listed as federally threatened or endangered, any mortality of ferruginous hawks would be considered a significant impact; however, the impact on the local population may not be biologically significant if the population is panmictic (Section 4.2.3.4).

There would be no impact to ferruginous hawks under the No Action Alternative.

As with bald eagles and peregrine falcons, cumulative impacts to the regional ferruginous hawk population would be potentially significant due to direct mortality associated with the proposed WTGs. Although a small portion of potential foraging and nesting habitat for ferruginous hawk has been removed through all past and existing developments (e.g., surface mining, oil and gas development), this would represent only a moderate impact to hawk populations; a majority of this habitat remains undisturbed and available to ferruginous hawks. Any loss of this species due to project-related mortality would be considered a significant impact.

<u>Loggerhead Shrike</u>. Loggerhead shrikes have occasionally been observed along the eastern edge of Foote Creek Rim in areas of sagebrush-grassland interspersed with trees and large shrubs; potential nesting habitat is scattered throughout the KPPA where large shrubs and trees occur adjacent to open areas.

Since it is likely that only a small amount of potential shrike nesting habitat will be disturbed by the proposed project or Alternative A, impacts to loggerhead shrike due to habitat disturbance and human presence would be negligible. Impacts to shrike foraging habitat under Phase I (319 ac or 0.5% of the KPPA), 500-MW Windplant (1,787 ac or 3.0% of the KPPA), or Alternative A (1,146 ac or 1.9% of the KPPA) would also be negligible; shrikes would probably shift their foraging activity to surrounding areas not impacted by the project. Mortality of shrikes due to collisions with WTGs is possible, but their relatively low number and scattered distribution in the KPPA would make this a rare occurrence; therefore, potential impacts to loggerhead shrikes due to collisions with WTGs would be negligible for the 500-MW Windplant or Alternative A.

There would be no impact to loggerhead shrikes under the No Action Alternative.

Because there is a relatively minimal amount of loggerhead shrike nesting habitat within the KPPA, existing and proposed disturbances (including the Windplant) would have a negligible cumulative impact on this species.

State Sensitive Species

Several state sensitive species have been observed or reported on or adjacent to the KPPA (Table 3.18). Four of these species (i.e., American white pelican, great blue heron, merlin, and upland sandpiper) have been observed frequently enough within the KPPA to merit a discussion of potential impacts of the Proposed Action or Alternative A.

The presence of WTGs and transmission lines in areas where these four species fly creates a risk of collision mortality. Mortality would be a significant impact due to legal considerations; population impacts are unknown because population dynamics for these species have not been studied.

Upland sandpiper habitat on the KPPA would be reduced due to physical disturbance and human presence in a manner similar to that described previously for other species. No upland sandpiper nests were found during avian surveys on the Foote Creek Rim or Simpson Ridge areas, although these areas could contain potential nesting habitat for this species. Upland sandpipers were observed in breeding displays on top of Foote Creek Rim in 1994 (Mariah 1994a). The impact of habitat reduction associated with Windplant development on upland sandpiper habitat would probably be moderate; if few sandpipers actually nest within areas to be developed, impacts to upland sandpiper habitat would be negligible. Habitats frequented by American white pelicans and great blue herons (i.e., wetland areas) and merlins (i.e., riparian zones) would not be avoided during Windplant development where feasible.

The No Action Alternative would have no impact on state sensitive bird species.

Overall, the negligible to potentially moderate (upland sandpiper) impacts on state sensitive bird species due to the proposed project would add a negligible amount to the cumulative impacts of other regional activities (e.g., ranching, oil and gas development, mining, transportation, recreation). Such a negligible increase is not expected to add to the potential significance of these cumulative impacts.

<u>4.2.4.4 Amphibians and Reptiles</u>

<u>Wyoming Toad</u>. Historic habitat for the endangered Wyoming toad is present in the Rock Creek drainage east of Foote Creek Rim; however, no toads are currently known to be present in the area. The Proposed Action and Alternative A would have no impact on the Wyoming toad, and would not add to the cumulative impacts due to other human activities that affect toads or their habitat.

<u>Eastern Short-horned Lizard</u>. This reptile species has been observed within the KPPA, and it is likely that much of the project area represents suitable habitat for the eastern short-horned lizard. Although some disturbance of areas containing short-horned lizards would likely occur during either the Proposed Action or Alternative A, overall loss of habitat for this species within the KPPA probably would be negligible (a maximum of 1,787 ac or 3% of the KPPA for the 500-MW Windplant). A slight increase in direct mortality of short-horned lizards would initially occur due to Windplant construction, and would remain slightly elevated for the LOP due to increased traffic; this impact to populations would also likely be negligible.

No impact would occur to this species under the No Action Alternative.

It is anticipated that the proposed project will not significantly increase existing and foreseeable cumulative impacts (e.g., oil and gas development,

mining, recreation) to short-horned lizards and their habitat in the region.

4.2.4.5 Plants

The only federally listed species that may occur in the KPPA is the threatened Ute lady's tresses orchid, which is found in bogs, wetlands, and riparian or seepage areas. These habitats will be avoided during placement and construction of facilities, and statewide, the species has only been documented in Goshen County. No impact to this species is anticipated from the proposed project or alternatives; therefore, no increase in cumulative impacts to this species is anticipated.

Contracted Indian ricegrass, a C2 species, also potentially occurs within the KPPA; however, an initial plant survey of the Foote Creek Rim area in 1994 did not reveal its presence in the area (Mariah 1994a). Additional surveys for the plant would be conducted in areas to be disturbed by phases subsequent to Phase I of the project. If found in these areas, the BLM and USFWS would be consulted to determine appropriate avoidance and/or mitigation measures. Impacts to contracted Indian ricegrass from the proposed project and alternatives are expected to be negligible; these impacts are not expected to significantly add to the cumulative impacts of existing and foreseeable development in the region.

Moist hills, slopes, and woods, which provide potential habitat for slender-trumpet ipomopsis, a state sensitive species, occur on only a small portion of the KPPA east of Foote Creek Rim. No WTGs are proposed for this area, and no impacts to the species (either specific to this project or cumulative) are expected. The other state sensitive species potentially occurring within the KPPA, bun milk-vetch, is a plant of bare slopes and ridges. This species was observed near the northern end of the transmission lines in 1920. Construction activity in this habitat may disturb individual plants in localized areas, but the extent of such disturbance would be small relative to the total amount of habitat available. The impact of the proposed project and alternatives on bun milk-vetch populations is expected to be negligible. There would be no impact to this species under the No Action Alternative. Project-related impacts to the bun-milk vetch and its habitat are expected to be a negligible addition to the cumulative impact of other existing and foreseeable development.

4.3 CULTURAL AND HISTORIC RESOURCES

4.3.1 Significance Criteria

Significant impacts to cultural resources would be:

- loss or destruction of cultural resources which are eligible for or listed on the NRHP,
- failure to comply with BLM procedures implementing federal cultural resource management practices,
- any surface-disturbing activities within 0.25 mi (0.40 km) of significant historic roads and/or trails, unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area within the buffer, and
- disturbance through construction activities of important Native American traditional or cultural sites.

4.3.2 Proposed Action

The significance of the Foote Creek Rim Archaeological District to certain Native American tribes is currently being evaluated ("Foote Creek Rim Archaeological District" is a descriptive term encompassing all features on top of Foote Creek Rim; the term does not currently have regulatory meaning) (see Section 3.3). An ethnohistoric/ethnographic analysis of the area is being prepared under consultation with these tribes. Potential impacts to significant Native American ceremonial or traditional features will be identified during the study, but may be kept confidential due to the sensitive nature of this

information. Because the consultations and impacts analysis are ongoing, a significance determination cannot be finalized at this time. However, significance determinations will be given in the FEIS.

Impacts to cultural resources from the Proposed Action could be direct or indirect. Direct impacts to cultural resources would be mitigated following procedures specified in 36 C.F.R. 800. Class I and Class III inventories have been conducted on portions of the Foote Creek Rim area, and would be conducted on all state and federal lands and on private lands affected by federal undertakings. All resources identified in Class III surveys would be evaluated for eligibility for the NRHP in consultation with the BLM and SHPO. Eligible or listed sites identified in the Class I and Class III inventories would be avoided, where feasible, as would areas with high potential for significant cultural deposits, such as sand dunes and alluvial terraces, where feasible. If any NRHP (eligible or listed) prehistoric sites found within the area cannot feasibly be avoided, a data recovery program would be implemented. Construction activities would be field checked as necessary by a qualified BLM archaeologist. If historic or prehistoric materials are discovered during construction, all activities within a 100-ft (31-m) radius of the site(s) would cease immediately, and appropriate BLM personnel would be notified by KENETECH or its subcontractors to assure proper handling of the discovery by qualified archaeologists.

Indirect impacts to cultural resources would be negligible since inventories and monitoring would locate most significant sites within and adjacent to road and power line ROWs. Potential impacts would be reduced through informing all personnel of the importance of the resources and the regulatory obligations to protect such resources. All personnel would be instructed that collection of cultural materials is prohibited. Historic trails and roads eligible for the NRHP would be avoided, where feasible, and no surface-disturbing activities would occur within 0.25 mi (0.40 km) of historic roads and/or trails, unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area within the buffer.

There are two reasonable scenarios of potential impacts to the Foote Creek Rim Archaeological District, although evaluation of the site and Native American consultations are on-going and new scenarios may arise as more information is obtained. First, the site could be considered eligible for the NRHP under Criterion D, which states that a cultural property must have, or have had, information to contribute to our understanding of human history or prehistory, and the information must be considered important, in which case physical avoidance of the features on the rim would be adequate mitigation.

Second, the features may be eligible for the NRHP under Criterion A. Properties can be eligible for the NRHP under Criterion A if they are associated with events or patterns of events that have made a significant contribution to the broad patterns of history. On Foote Creek Rim, features may be associated with Native American events involving their use of the area as a traditional cultural property (TCP). A TCP, in association with Criterion A requirements, may be eligible for inclusion on the NRHP because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. In order to achieve such significance, the property must retain integrity of setting (i.e., the physical environment of a property). Whereas location refers to the specific place where a property was built, setting refers to the *character* of the place in which the property played its historic role. Eligibility for the NRHP under Criterion A, and possibly as a TCP, is being evaluated during the ethnohistoric/ethnographic study of the site. If the district is determined to be eligible due to its significance to Native Americans, Windplant development could constitute a significant impact to the cultural resources on the Foote Creek Rim area. Mitigation for this impact would involve development of a mitigation plan. Options for the

mitigation plan could be developed in consultation with the concerned Native American tribes.

Seventeen sites were recorded along Alternate 3. Three historic sites have been recommended as eligible, but a final determination will be made by the BLM in consultation with SHPO. These three sites, however, have the potential of being impacted by construction activities. The remaining 14 sites have been recommended as not eligible for inclusion on the NRHP and no impacts would occur to these cultural resources.

A 12-ft (4-m) segment of the 1868 UP Railroad grade (Site 48CR4328) could easily be spanned by the overhead transmission line, thereby eliminating all direct impacts to the site, however, a visual impact to the site may still be present. Mitigation of adverse impacts would be determined through consultation among the BLM, SHPO, and Advisory Council on Historic Preservation (ACHP).

Sites 48CR5755 and 48CR5772 are the Carbon Mine No. 7 and the UP Railroad Spur constructed to service the mine. Direct impacts to these sites would be avoided by placing the structures outside of the site boundaries.

There are no known potentially eligible sites along Alternates 1 and 2, but Class III surveys of these routes have not been completed. If either of these routes is selected in the ROD, a Class III survey would be completed prior to transmission line construction, and all eligible sites would be avoided, if feasible, or impacts mitigated. Because PacifiCorp has the capability to place structures away from sensitive resources, it is unlikely that any direct impact to cultural resources would occur from construction along these routes. Indirect visual impacts would occur, and thus, impacts would be moderate for the LOP and possibly beyond.

Beneficial impacts to cultural resources from the Proposed Action could include the discovery of important cultural resources during Class III surveys of proposed development areas.

4.3.3 Alternative A

Under Alternative A, impacts to cultural resources within the Foote Creek Rim Archaeological District would be similar to those for the Proposed Action because the first phase of Windplant development (70.5 MW) would occur on Foote Creek Rim. If the site is determined eligible for the NRHP under Criterion D only, impacts would be negligible for the LOP. If the district is determined eligible under other criteria as well as Criterion D, impacts would be significant for the LOP. Impacts associated with the remaining development would be reduced by approximately 40% from the Proposed Action because fewer WTGs and facilities would be erected and so there would be greater opportunity to avoid cultural resource sites. Impacts associated with transmission line construction would be the same as for the Proposed Action. Beneficial impacts resulting from the discovery of important cultural resources would be reduced by approximately 40%.

4.3.4 No Action

Under the No Action Alternative, no impact to cultural resources would occur. However, the potential to discover significant cultural resources during future Class III surveys of development areas would be lost.

4.3.5 Cumulative Impacts

Negative cumulative impacts of the numerous developments in southern Wyoming would include increased visitation by construction and survey crews to cultural resource sites and vandalism. Although these impacts can be mitigated, the adverse impacts would not occur in the absence of surface-disturbing projects. Because predisturbance surveys and mitigation are required for all developments, adverse cumulative impacts would be negligible.

Cumulative impacts to cultural resources are most often thought of in negative terms, since archaeological sites are non-renewable resources

and any impact may adversely affect the total number of sites on the landscape. Furthermore, increased visitation from construction and survey crews and from the general public may lead to increased vandalism of archaeological sites. However, the scientific discovery of archaeological sites and the accumulated evidence of prehistoric social organization and subsistence strategies may, in fact, be beneficial cumulative impacts of development projects. Negative cumulative impacts may include the disturbance and/or loss of unidentified sites, features, or artifacts that could increase information about our heritage in the KPPA and throughout the region. If these cultural resources are not identified, inventoried, and/or appropriately protected prior to disturbance, then the cumulative loss of scientific information may irrevocably destroy the archaeological record.

If the Foote Creek Rim Archaeological District is eligible for the NRHP under Criterion A, then the cumulative impacts to the setting of the district from the Proposed Action and any future undertakings may be continually weakened to the point of loss of integrity of the setting. This would undermine the recommended eligibility determinations.

4.4 SOCIOECONOMICS

4.4.1 Significance Criteria

Impacts to socioeconomic features would be considered significant if project-related activities resulted in:

- population growth beyond the capacity of communities to provide adequate housing, schools, and services, or otherwise adapt to growth-related social and economic changes;
- revenue flows and expenditures by local, county, or state governments that are inadequate to maintain public services and facilities at established levels;
- any permanent displacement of residents or users of affected areas;
- perceived changes in existing ways of life resulting in community discontent sufficient to create organizational response and conflict; or
- a "boom and bust" cycle of employment and related economic growth and decline.

4.4.2 Proposed Action

4.4.2.1 Employment

Most employees would be hired locally for construction and operation of the Windplant; therefore, impacts to employment would be beneficial for the LOP. Windplant construction would occur from 1995 through 2004; PacifiCorp's transmission line construction would occur in 1995 only. For construction, 161 full-time employees would be hired during the second and third quarters of 1995 (Appendix E). Sixty person-days of dozer operator employment, for reclamation work, would be provided during the fourth quarter of 1995. Construction employment would decrease to 86 full-time construction employees hired for the second and third quarters of years 1996 through 2004. Eighteen trades would be needed for construction, including 46 laborers in 1995 and 30 during the years 1996 through 2004; other occupations would be in the construction, electric, and equipment operation fields.

O&M personnel (Windsmiths) would be employed throughout the LOP. Windsmith is a unique occupation created and trained by KENETECH. Starting at nine employees in 1995, the number of Windsmiths would increase gradually (by two or three additional employees each year) to 29 employees in 2004 (Appendix E). After the completion of construction, Windplant employment levels would remain at 29 employees during the years 2004 through 2034. Peak employment levels would occur during the second and third quarters of 1995 (when Phase I and transmission line construction are occurring), at a level of 170 employees.

The local labor pool in Carbon and Albany Counties would be primarily used to fill positions. A shortage of applicants exists for job

classifications associated with transmission line construction and industrial electricians (Table 4.17). An adequate supply of applicants for most other fields is available. A large number of master electricians is available, especially construction electricians. These individuals would be used to fill many of the electrician positions and would be trained for the Windsmith positions.

Approximately 90% of Windplant employees would be drawn from the local labor pool. In-migrant workers would make up 10% of the labor force except when skills were in short supply locally (e.g., workers for transmission line construction). The number of in-migrant employees would range from one worker during the first quarter of 1995 to 47 in-migrants during the second and third quarters of 1995 (Table 4.18). The number of local hires would range from nine workers during the first quarter of 1995 to 123 local hires during the second and third quarters of 1995. After 2004, the proportion of local hires to in-migrants is projected to be 26:3.

Employment levels at the Windplant would represent less than 1% of total employment in Carbon and Albany Counties. Construction employment would be a short-term beneficial impact, and O&M employment would be a long-term benefit. The short-term employment of construction workers would have a impact on employment levels in the two counties during the last quarter of 1995 when construction workers from the Windplant begin to look for work elsewhere; but this impact would not be significant.

Construction payroll for the project would start at $3,169,285 in 1995, decrease to $1,760,635 in 1996 and gradually increase during the construction period to $2,409,548 in 2004 (Appendix E). The O&M payroll would start at $253,094 in 1995 and increase to $3,764,768 in 2034. Average second and third quarter construction salaries (six-month period) would range from $19,685 in 1995 to $28,018 in 2004. Average annual O&M salaries would range from $28,122 in 1995 to $129,820 in 2034. Total payroll paid during the LOP (1995 through 2034) is projected to be $96,102,427.

Local workers would be utilized to the maximum extent feasible. It is estimated that about 90% of employees would be current residents of Carbon and Albany Counties. Most employees would probably come from Rawlins, Hanna, Saratoga, Laramie, and other communities within 80 mi (128 km) of the Windplant. Job openings would be advertised locally through newspapers, Wyoming Job Service, and unions. Residents of Carbon and Albany Counties would receive hiring preferences.

Little long-term employment impacts would result from the proposed project. Jobs created by the Windplant would represent a small proportion of total employment in the region. No mitigation measures would be needed.

4.4.2.2 Population

Since the majority of Windplant employees (approximately 90%) would be residents of Carbon and Albany Counties, population in the region would change very little due to Windplant development; therefore, population impacts would be negligible for the LOP. Using an average household size of 2.1 persons, (assuming that many workers would not be accompanied by families), migration rates into the area would range from 99 during 1995 to 6 during years 2005 through 2034 (Table 4.19). Migration rates would be higher if KENETECH and PacifiCorp are unable to obtain sufficient numbers of employees from the local labor pool in the future. Because the level of population change that would be created by the Windplant is low, there would be negligible LOP impacts on the region's population as a result of the Proposed Action. No mitigation measures would be needed. Most in-migrants would probably move to Carbon County to avoid competition for housing with University of Wyoming students in Laramie (Table 4.20). Approximately 45% of in-migrants would be expected to move to the Rawlins area because of the current availability of housing in that community.

Table 4.17 Labor Availability Based on Job Applicants with Wyoming Department of Employment.[1]

Job Classification	Active Applicants on 8/31/94			Active Applicants 8/31/93 through 8/31/94		
Construction	Carbon County	Albany County	Total	Carbon County	Albany County	Total
Windplant						
Carpenter/form setter	1	1	2	4	3	7
Cement finisher	5	3	8	22	28	50
Cement, rebar	65	78	143	324	333	657
Electrician, helper	6	10	16	11	24	35
Electrician, industrial[2]	1	1	2	6	1	7
Electrician, master[3] (also eligible as Windsmith)	2	7	9	23	37	60
Laborer	34	16	50	169	56	225
Structural steel worker	1	1	2	10	5	15
Backhoe operator	10	1	11	43	2	45
Cherry picker operator	0	0	0	2	0	2
Cable crane operator	1	3	4	5	4	9
Dozer operator	7	1	8	41	2	43
Power shovel operator	10	1	11	43	2	45
Road roller operator	1	0	1	4	0	4
Transmission line						
Foreman	0	0	0	0	1	1
Lineman	0	0	0	1	0	1
Equipment operator	27	33	60	141	161	302
Laborer (see above)	--	--	--	--	--	--
Wireman	0	0	0	1	0	1
Operations						
Windsmith[4] (see also electrician, master)	0	0	0	3	0	3
Total	171	156	327	853	659	1512

[1] Wyoming Department of Employment, Employment Resources Division 1994.
[2] Based on applicants for electrician, maintenance; electrician, powerhouse (utilities); and electrician, substation (utilities).
[3] Based on applicants for electrician (construction); electrician supervisor (substation); and electrician supervisor (any industry).
[4] Based on applicants for load dispatcher and power plant operator. Electricians, master would also qualify as Windsmiths.

Table 4.18 Estimates of Locally Hired and In-migrant Projected Employment.[1]

	1995 Quarters				1996 Quarters				1997 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	9	123	123	9	10	84	84	10	12	86	86	12
In-migrants	1	47	47	1	1	13	13	1	1	13	13	1
	1998 Quarters				1999 Quarters				2000 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	14	88	88	14	15	89	89	15	18	92	92	18
In-migrants	1	13	13	1	2	14	14	2	2	14	14	2
	2001 Quarters				2002 Quarters				2003 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	20	94	94	20	23	97	97	23	24	98	98	24
In-migrants	2	14	14	2	2	14	14	2	3	15	15	3
	2004 Quarters				2005-2034 Quarters							
	1st	2nd	3rd	4th	1st	2nd	3rd	4th				
Local hires	26	100	100	26	26	26	26	26				
In-migrants	3	15	15	3	3	3	3	3				

[1] Local hires are those employees who were residents of Carbon or Albany Counties during the previous year. In-migrant employees are those employees who were not residents of Carbon or Albany Counties during the previous year. Table includes construction and O&M employees.

Table 4.19 In-migrant Population Projections, 1995-2034.[1]

	1995 Quarters				1996 Quarters				1997 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
In-migrant population	2	99	99	2	2	27	27	2	2	27	27	2

	1998 Quarters				1999 Quarters				2000 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
In-migrant population	2	27	27	2	4	29	29	4	4	29	29	4

	2001 Quarters				2002 Quarters				2003 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
In-migrant population	4	29	29	4	4	29	29	4	6	32	32	6

	2004 Quarters				2005-2034 Years
	1st	2nd	3rd	4th	
In-migrant population	6	32	32	6	6 additional in-migrants each year during this period.

[1] Based on Table 4.18. In-migrants are those persons who were not residents of Carbon or Albany County during the previous year. Assumes a household size of 2.1 for each in-migrant employee.

Table 4.20 Total In-migrant Population Distribution, 1995-1999.[1]

Location	Available Housing Distribution	Population, 1995 Quarters 1st	2nd	3rd	4th	Population, 1996 Quarters 1st	2nd	3rd	4th
Carbon County									
Hanna	11%	0	11	11	0	0	3	3	0
Rawlins	45%	2	45	45	2	2	12	12	2
Saratoga	19%	0	19	19	0	0	5	5	0
Albany County	25%	0	24	24	0	0	7	7	0
Total		2	99	99	2	2	27	27	2

Location	Population, 1997 Quarters 1st	2nd	3rd	4th	Population, 1998 Quarters 1st	2nd	3rd	4th	Population, 1999 Quarters 1st	2nd	3rd	4th
Carbon County												
Hanna	0	3	3	0	0	3	3	0	0	3	3	0
Rawlins	2	12	12	2	2	12	12	2	2	13	13	2
Saratoga	0	5	5	0	0	5	5	0	0	6	6	0
Albany County	0	7	7	0	0	7	7	0	2	7	7	2
Total	2	27	27	2	2	27	27	2	4	29	29	4

Based on Bureau of the Census (1992a, 1992b) and Table 4.19. Assumes limited housing availability in Albany County.

4.4.2.3 Housing

Little, if any, additional housing would be required for Windplant employees. Approximately 90% of employees would already live in the area. Additional housing would be required for 47 households in 1995 (Table 4.21), 13 households in years 1996 through 1998, and 14 households in 1999. As discussed in Section 3.4.3, vacant housing is available in the region and would be adequate to meet employees' needs; therefore, impacts on housing would be negligible for the LOP.

At least 861 housing units or spaces for temporary housing are available in the Carbon-Albany County area (see Section 3.4.3). More rental units are being advertised in Laramie than Rawlins, but there is a high student demand for these units. Construction workers during summer months would compete with tourists for space in campgrounds and units in motels. If housing demand increases in Carbon County, more housing units may come on to the market.

Housing in the immediate vicinity of the KPPA is limited. Housing is unavailable in the towns of Arlington, Elk Mountain, and McFadden. Opportunities are available in these communities and surrounding rural areas to purchase property and construct new housing.

Little impact would occur to the supply of housing in Carbon and Albany Counties. The project has a low demand for additional housing. No mitigation measures are needed.

4.4.2.4 Schools

Schools in the area are not experiencing crowding; both Carbon County School Districts have space for additional students (Section 3.4.4). Albany County schools can enroll additional students, but junior high and high schools are near capacity. Most students of Windplant employees would already live in the region. As a result of the proposed project, space would be needed for an estimated 17 additional students in 1995 which is projected to decrease to 5 students in 1996 (Table 4.22). Current facilities would be able to handle the additional students. Little impact would occur to schools as a result of the project. No mitigation measures would be needed.

4.4.2.5 Local Government Taxation and Revenue

Sales tax and *ad valorem* tax (property tax) would be paid to local governments by the Windplant (Appendix E); therefore, impacts to local government revenue would be beneficial for the LOP. Sales tax on purchases of equipment and services would be paid during the years 1996 through 2004 and would vary from a high of $2,316,834 (in 2003) to a low of $1,445,705 (in 2004). Currently, sales tax is paid at a rate of 5% in Carbon County with 4% going to the State of Wyoming and 1% going to Carbon County.

Property tax would be paid throughout the LOP. Assessed value of the Windplant is 11.5% of the Windplant's fair market value, which would increase during Windplant construction (through 2005) and then depreciate (2006 to 2034). Property tax to be paid annually by the Windplant would range from $790,014 in 1996 to $5,668,369 in 2005, then would decline to $16,063 in 2034 (Appendix E). Schools would receive 80.8% of the property tax; therefore, the project would have a beneficial impact on government revenues.

Impact assistance funds may be paid to Carbon and Albany Counties by the State of Wyoming to mitigate adverse impacts to communities affected by Windplant construction and operation. The industrial siting council

> . . . shall, after consideration of all evidence and recommendations presented at the hearing held pursuant to W.S. 35-12-110, establish a ratio for distribution of impact assistance funds to the county and to the cities and towns therein for the county where the industrial facility is located and shall certify that ratio to the county treasurer who will thereafter distribute the impact assistance payments

Table 4.21 Projected Housing Demand for In-migrants[1], 1995-1999.

Location	Available Housing Distribution	Housing Units 1995 Quarters 1st	2nd	3rd	4th	Housing Units 1996 Quarters 1st	2nd	3rd	4th
Carbon County									
Hanna	11%	0	5	5	0	0	1	1	0
Rawlins	45%	1	22	22	1	1	7	7	1
Saratoga	19%	0	9	9	0	0	2	2	0
Albany County	25%	0	11	11	0	0	3	3	0
Total		1	47	47	1	1	13	13	1

Location	Housing Units 1997 Quarters 1st	2nd	3rd	4th	Housing Units 1998 Quarters 1st	2nd	3rd	4th	Housing Units 1999 Quarters 1st	2nd	3rd	4th
Carbon County												
Hanna	0	1	1	0	0	1	1	0	0	1	1	0
Rawlins	1	7	7	1	1	7	7	1	1	7	7	1
Saratoga	0	2	2	0	0	2	2	0	0	3	3	0
Albany County	0	3	3	0	0	3	3	0	1	3	3	1
Total	1	13	13	1	1	13	13	1	2	14	14	2

[1] Based on Table 4.20.

Table 4.22 Projected Distribution of In-migrant School Enrollment[1], 1995-1999.

Location	Available Housing Distribution	Additional Students 1995 Quarters				Additional Students 1996 Quarters			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th
Carbon County									
Hanna	11%	0	2	2	0	0	1	1	0
Rawlins	45%	0	8	8	0	0	2	2	0
Saratoga	19%	0	3	3	0	0	1	1	0
Albany County	25%	0	4	4	0	0	1	1	0
Total		0	17	17	0	0	5	5	0

Location	Additional Students 1997 Quarters				Additional Students 1998 Quarters				Additional Students 1999 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Carbon County												
Hanna	0	1	1	0	0	1	1	0	0	1	1	0
Rawlins	0	2	2	0	0	2	2	0	1	2	2	1
Saratoga	0	1	1	0	0	1	1	0	0	1	1	0
Albany County	0	1	1	0	0	1	1	0	0	1	1	0
Total	0	5	5	0	0	5	5	0	1	5	5	1

[1] Based on Table 4.20 and a school-aged population of 17.8% of total population based on Bureau of the Census (1992a). Base year of 1994.

to the county and cities and towns therein pursuant to that ratio.

> The ratio of impacts shall be established in consideration of, but not limited to, the following factors:
> - The residency pattern of the facility's direct and induced employment;
> - The capital facility needs, social service needs, heath care needs, transportation needs, recreational needs, and police and fire protection needs of the affected local governments; and
> - The revenue structure, expenditure level, mill levies, and financial capabilities of the affected local governments . . . .
>
> . . . Upon the certification of a ratio to the county treasurer, the impact assistance payments shall thereafter be distributed pursuant to that ratio.
>
> The Council may adjust, revise, or modify a certified ratio during the construction of a facility. A governing body which is primarily affected by the facility, or any person issued a permit pursuant to W.S. 35-12-106, may petition the Council for review and adjustment of the distribution ratio upon a showing of good cause. The request shall be submitted to the Office of the Industrial Siting Administration . . . .
>
> . . . Pursuant to W.S. 39-6-411(c) and W.S. 39-6-512(b), the Council, upon request from the County Commissioners of an adjoining county, may determine that the social and economic impacts from construction of an industrial facility upon the adjoining county are significant and establish the ratio of impacts between the counties and certify that ratio to the state treasurer who will thereafter distribute impact assistance payments to the counties pursuant to that ratio or any revised, adjusted, or modified ratio certified under these regulations . . . .

4.4.2.6 Social Indicator Data

Most Windplant employees would be hired locally, so social indicators would either show no change or a slight improvement as a result of the project. Additional employment opportunities would be provided to about 123 persons living in the region in 1995. If any of these persons are living below the poverty level or receiving social assistance, employment at the Windplant would allow them the opportunity to improve their living standards.

For other social indicators such as education levels and crime rates, the Windplant project would have no effect. No mitigation measures are needed.

4.4.2.7 Community Characteristics, Facilities, and Infrastructure

The power generated by the Windplant will be exported to other states served by PacifiCorp, Tri-State, PSCo, EWEB, and BPA. The Windplant will provide a very small percentage of the power sold by Tri-State, the supplier of Carbon Power and Light (which services the communities around the KPPA). While the Windplant would not contribute to electric power rate decreases, it would help reduce potential rate increases for the customers of these four utilities and BPA for the following reasons:

- Unlike fossil fuel plants which are subject to fuel cost inflation, wind is free. In a typical gas-fired plant, for example, fuel makes up about 50% of the cost of each kWh. With a Windplant, the only portion of the kWh cost subject to inflation is O&M. Therefore, no fuel inflation costs (for Windplant-generated electricity) would be passed on to the customers of these utilities.
- The Production Tax Credit increases with inflation over the next 10 years, and this lowers the cost of Windpower proportionally each year.

Communities that would be most affected by the Windplant would be Arlington, McFadden, Elk Mountain, and Hanna. Since the Arlington/McFadden/Elk Mountain/Hanna area would be the only location in Wyoming with a wind-generated electric power plant, the Windplant would be a key community characteristic of these four communities, but this is not expected to be significant. Characteristics of other communities in Carbon and Albany Counties would not be affected by the Windplant. The project would not impact community facilities and infrastructure in other communities. No large-scale population increase would occur that would require the construction of new community facilities and infrastructure.

Landowners within the KPPA would benefit directly from the project through land rental. Amounts to be paid are proprietary.

The Windplant would require electricity, water, and sewer services. Electricity would be provided by Carbon Power and Light Company. For 500-MW generation, the Windplant would require 2.5 MW of electricity when the ambient temperature is above 32 °F (0° C) and 3.5 MW when the temperature is below 32 °F (0 °C). For 70.5-MW generation, 350 kilowatts (kW) of electricity would be required when the ambient temperature is above 32 °F and 900 kW when the temperature is below 32 °F (0 °C).

Water for the Windplant would be obtained from existing wells. Solid waste and sewage would be collected and disposed of in compliance with all applicable regulations by a local contractor.

Impacts on transportation within and adjacent to the KPPA would be negligible for construction and the LOP. Traffic would increase on I-80 and Wyoming Highways 30/287, 13, and 72, but these highways are currently well under service capacity (Section 3.4.8) and would easily accommodate the additional traffic. Roads built or improved for Windplant construction and O&M would be designed for their expected level of service and types of vehicles (e.g., large tractor-trailers hauling towers, nacelles, rotors, transformers, etc.). All vehicles and loads would be in compliance with state and federal regulations.

4.4.2.8 Overall and Indirect Benefits

Beneficial impacts would include jobs produced, materials purchased, state and local taxes paid, and capital investment:

- The total value of materials to be purchased in Wyoming during the LOP is estimated to be $44,076,699 (net present value of $19,973,552 at 7%).
- State and local taxes paid during the LOP would total $121,199,776.
- Capital investment during the LOP would total $671,444,967 (net present value of $473,614,323).

4.4.3 Alternative A

Under Alternative A, each phase of Windplant development would probably be similar to the Proposed Action (i.e., 50- to 100-MW phases would be built) but because the Windplant would be reduced in size, the number of phases would be reduced; therefore, the number of construction years would be reduced by approximately 40%. Construction probably would occur from 1995 through the year 2000 instead of 2004, reducing the overall construction work force by 86 employees per year for four years. Similarly, because there would be fewer turbines, the O&M staff would be reduced from 29 to approximately 21 Windsmiths. The annual number of in-migrants during construction (1995 to 2000) would probably be the same as for the Proposed Action because labor forces needed for construction would be similar. Transmission line construction employment would be the same as for the Proposed Action.

Employment levels at the Windplant would represent less than 1% of total employment in Carbon and Albany Counties and would be a short-term beneficial impact, but benefits would be reduced by approximately 40% from the Proposed Action. Short-term adverse impacts during the last

quarter of each construction year would be the same as for the Proposed Action, but would not occur during 2001 to 2004.

Construction payroll would start at $3,169,285 in 1995, decrease to $1,750,635 in 1996, and gradually increase during the construction period to $2,059,700 in 2000 (Appendix E). The O&M payroll would start at $253,094 in 1995 and increase to approximately $2,258,861 in 2034 (assuming a 40% reduction in O&M payroll). Average salaries would be the same as for the Proposed Action. Total payroll paid during the LOP would be approximately $57,661,456.

Few long-term employment impacts would result from Alternative A. Jobs created by the Windplant would represent a small proportion of total employment in the region, and thus, no mitigation measures would be needed.

Under Alternative A, population would change very little during Windplant development. Impacts under the Proposed Action would be negligible, and thus, the reduced Windplant would also have negligible impacts on population. Approximately 45% of in-migrants would be expected to move to the Rawlins area to avoid competition for housing with students in Laramie.

Little, if any, additional housing would be required under Alternative A. Competition between construction workers and tourists during summer months would be the same as for the Proposed Action but would cease in 2000. Additional housing would be required for 47 households in 1995 (Table 4.21) and another two households during the period from 1996 through 2000. Vacant housing is available in the region and would be adequate to meet employee needs.

Because housing impacts would be negligible under Alternative A, no mitigation measures would be needed. Impacts on schools also would be negligible.

Sales tax on purchase of equipment and services would range from $1,760,604 in 1996 to $2,059,657 in 2000. Property tax paid annually by the Windplant would range from approximately $9,638 in 2034 to $1,833,755 in 2000. Schools would receive 80.8% of the property tax; therefore the project would have a beneficial impact on government revenues. Impact assistance payments, discussed in Appendix E, would be lower than for the Proposed Action. No other mitigation measures would be needed.

Social indicators would either show no change or slight improvement under Alternative A.

The communities of Arlington, Elk Mountain, McFadden, and Hanna would be most affected by Alternative A; however, Windplant development would not impact facilities or infrastructure of these or other communities in the area. Rental to landowners would be at the same rate as for the Proposed Action.

Impacts under the Proposed Action are primarily beneficial, and thus, Alternative A would result in reduced benefits:

- The total value of materials to be purchased in Wyoming during the LOP would be approximately $26,446,019.
- State and local taxes paid would total approximately $72,719,866.
- Capital investment during the LOP would total $402,866,980.

4.4.4 No Action

Under the No Action Alternative, beneficial impacts from increased employment and increased state and local tax revenues would not be realized. No adverse affects due to Windplant development would occur.

4.4.5 Cumulative Impacts

Cumulative impacts of the Windplant project and three other projects in Carbon County are shown in Table 4.23. The environmental analysis for the proposed Medicine Bow windfarm has not been completed and thus is not included in this table. The other three projects are located in western

Table 4.23 Socioeconomic Cumulative Impacts.

Category	Creston/Blue Gap Natural Gas Project[1]	Mulligan Draw Gas Field Project[2]	Greater Wamsutter Area Natural Gas Project[3]	Proposed Action
Type of project	Natural gas	Gas field	Natural gas	Windplant, electricity generation
Years of duration	1994-2019	1992-2022	1992-2012	1995-2034
Employment	Up to 180 persons, local	40-100 persons, local	240-340 persons, local	9-29 O&M employees; 86-161 construction employees; 90% local employment
Payroll				
Average annual	$ 3,319,000	$667,000-$867,000	No data available	$ 2,403,000
Total	$82,987,000	$20,000,000-$26,000,000		$96,103,000
Population	Short-term population increases	Negligible population increases, short duration	Short-term 50% increase in Wamsutter's population	Negligible long-term population increase
Housing	Adequate housing available	Adequate housing available; workers already living in area; site work camps may be used	Possible temporary relocations	Demand for 47 additional housing units in 1995; 12 units in years 1996-1998, and 14 units in 1999
Schools	No data available	No data available	No data available	Space required for 5-17 additional students by year 1999
Local sales, severance, and *ad valorem* taxes	Annual average: $ 2,427,200 total during LOP: $72,816,000	Annual average: $ 1,900,000 to $ 2,200,000 total during LOP: $57,000,000 to $65,000,000	Annual average: $ 1,188,000 total during LOP: $23,760,000	Annual average: $ 302,999 total during LOP: $121,199,776
Social indicators	Minor crime increase; decreased unemployment	Minor crime increase; decreased unemployment	Disruption of ranching operations; decreased unemployment	Decreased unemployment
Communities directly affected	Baggs and Wamsutter	Baggs and Wamsutter	Wamsutter	Arlington, Elk Mountain, McFadden, and Hanna

[1] BLM (1994d).
[2] BLM (1992b).
[3] BLM (1992a).

Carbon County, away from the KPPA. All four projects would produce increased employment and tax revenues. Population impacts of the projects would be low-level except for short-term population increases from the Greater Wamsutter Area Natural Gas Project in the community of Wamsutter. Impacts on housing supply and schools from these projects are expected to be negligible. A minor crime increase is expected from the other three projects. This should effect communities in western Carbon County rather than communities in eastern Carbon County where the Windplant is proposed.

4.5 LAND USE

4.5.1 Significance Criteria

Impacts to land use would be considered significant if Windplant development resulted in violations of prior land use rights.

4.5.2 Proposed Action

Under the Proposed Action, no significant impact in land use is expected. Moderate impacts would occur due to an overall change in landscape character from a remote to an industrial character and a decline in the aesthetic quality of the land for recreational uses.

No permanent changes in land use would occur within the KPPA as a result of the Proposed Action; all surface equipment would be removed from the area at the end of the economic life of the project, and reclamation would restore disturbed sites to near pre-project conditions. The Proposed Action would be in conformance with county, state, and/or federal land use plans (Carbon County Planning and Development Commission 1983; Wyoming State Land Use Commission 1979; BLM 1987).

Approximately 319 ac (<1% of the KPPA) of new disturbance would occur during Phase I of the Proposed Action (Table 4.1). Initial reclamation following construction would reduce the disturbance area to 68 ac. The 500-MW Windplant would initially disturb approximately 1,787 ac (3%) of the KPPA. This disturbance would be reduced to 715 ac (1%) for the LOP. The project would temporarily change the land use of specific sites to energy development and displace or interfere with some historical land uses on a localized basis as described below.

4.5.2.1 Landscape Character

The shortgrass prairie/sagebrush steppe ecosystems within the KPPA support multiple land uses, primarily livestock and wildlife grazing and foraging. Mineral development and dispersed recreation also occur (Section 3.5). Based on the quantitative analyses provided below, none of the current land uses would be significantly impacted by the Proposed Action. Furthermore, the proposed Windplant would be an additional beneficial use of the land (as an electric power generator). However, in a qualitative sense, landscape character would be significantly altered.

Within the Simpson Ridge area, the KPPA landscape is relatively pristine, and the mark of man is not readily apparent. These remote lands are generally undeveloped, and they epitomize the harsh beauty that many people associate with Wyoming's uninhabited high plains. Current land uses neither diminish these aesthetic qualities of the landscape nor do they significantly detract from them. However, large numbers of wind turbines, roads, power lines, and substations distributed throughout the KPPA would change the overall appearance of the landscape. The relatively undeveloped and pristine landscape would take on an industrial character. While little quantifiable recreational use occurs within the KPPA, the conversion of 60,619 ac from a relatively undeveloped to a primarily industrial character is a qualitative loss of wildland. In addition, secondary impacts from increased traffic on new roads and increased human presence within the KPPA, as well as the accompanying wildlife disturbance (including poaching), noise, exhaust emissions, vandalism, and litter would occur.

On the Foote Creek Rim area, 5,000 ac would be used to support the multiple land uses, including the operation of a 200-MW Windplant (25 ac/MW). During early planning, KENETECH enlarged the Simpson Ridge Project area so KENETECH and the BLM would have greater opportunity to locate turbines and other facilities in environmentally preferable areas and thereby avoid or minimize impacting sensitive resources. Future PODs (post-Phase I) may identify critical areas where Windplant development would be prohibited (e.g., RCAs, cultural resource sites); therefore, it is unlikely that 500-MW Windplant development would occupy the entire Simpson Ridge area.

KENETECH's Windplant in Minnesota uses Model 33M-VS turbines, and the 25-MW Windplant occupies a 2,000-ac project area (80 ac/MW). In the Environmental Impact Report for the SMUD-Solano Wind Project (SMUD 1993), an estimated 4,000 ac would be used to generate 50 MW (80 ac/MW). Acres used per MW of capacity within the Simpson Ridge area would probably be about the same (i.e., 80 ac/MW) because the winds are not as strong as those in the Foote Creek Rim area. Assuming the worst case for the Simpson Ridge area (i.e., utilization of the entire 54,893-ac project area), the Windplant would occupy 183 ac/MW, or about twice the amount of land used per MW compared with the Minnesota and California sites. This would be a significant change in landscape character over a large area. If the Simpson Ridge portion of the Windplant only uses 80 ac per MW, then only 24,000 ac within the Simpson Ridge area would take on an industrial character.

The Windplant capacity factor (i.e., the average power output relative to the total potential output) also would affect ac/unit output. The Foote Creek Rim portion of the Windplant is expected to have a capacity factor of 72.8% (i.e., the Windplant would typically operate at 72.8% of its capacity) (Section 1.1.2); therefore, land use would be approximately 34 ac/MW. Assuming that the capacity factor would be similar within the Simpson Ridge portion of the Windplant, 110 ac/MW would probably be needed. Under the worst case scenario, 251 ac/MW would be used.

To reduce land area occupied by the Windplant within the Simpson Ridge area, turbines could be clustered into selected areas, where turbine densities would be higher than if they were more evenly dispersed. Effects of turbine density on such resources as raptors and big game herds are as yet unknown, but would be monitored and quantified as each phase was built. The BLM may recommend increasing turbine densities in the Simpson Ridge area to reduce the amount of land impacted by the aesthetic change and accompanying secondary impacts.

As future phases are planned, PODs would analyze potential impacts of higher turbine densities on changes in land use character, as well as impacts on other resources, to minimize the amount of land used for the project, wherever feasible. Construction of the first few phases on the Foote Creek Rim area, where turbine density would average approximately 8 ac/turbine, would provide the opportunity to evaluate impacts from high turbine densities. If during monitoring, significant impacts can be directly or indirectly attributed to high turbine densities, early phases of project development in the Simpson Ridge area may require a higher dispersal of wind turbines to minimize these impacts. Priority would be given to resources protected by state and federal laws (e.g., the MBTA, ESA), or by prior management decisions (e.g., the GDRA RMP, ROW grant, stipulations resulting from this EIS). Each phase would be monitored to evaluate effects of turbine density on specific resources and assist in planning future phases.

4.5.2.2 Agriculture/Rangeland

Livestock grazing would continue within the KPPA throughout the LOP; impacts due to the proposed project would be negligible. However, there would be a reduction in available forage during construction, and to a lesser extent, for the LOP. Construction of the first phase would result in a loss of approximately 40 AUMs initially and

8 AUMs over the LOP. The greatest reduction in AUMs would occur within the Arlington Allotment; 12 AUMs (5% of the AUMs in this allotment) would be lost initially, and the LOP reduction would be approximately 6 AUMs (2% of the AUMs in this allotment).

The Proposed Action would result in a reduction of 243 AUMs initially and 93 AUMs over the LOP, distributed throughout seven grazing allotments. The greatest loss of AUMs would occur within the Arlington Allotment; 24 AUMs (9% of AUMs in this allotment) would be lost initially, and 11 AUMs (4% of AUMs in this allotment) would be lost for the LOP. Although forage reductions and impacts would occur, lessees are being compensated by KENETECH.

Mitigation for loss of forage would entail the reclamation of disturbed sites to range conditions equal to or better than pre-project conditions. As soon as practicable, reclamation and revegetation would be completed on areas no longer needed for project construction or operation. In addition, turbines and ancillary facilities would be situated such that livestock would not be denied access to water sources nor subject to project-related hazards. Therefore, effects on grazing and general livestock use would be negligible for the LOP and beyond.

4.5.2.3 Developed Water Resources

All construction activities and facilities would be located at least 500 ft (152 m) from perennial impoundments and 100 ft (31 m) from ephemeral impoundments to avoid potential impacts to these resources (Section 4.2.2). Impacts to developed water resources would be negligible.

4.5.2.4 Extractive Mineral Operations/Oil and Gas Production

Impact to mineral resources would be negligible for the LOP and beyond (Section 4.1.3).

4.5.2.5 Recreation

No developed recreation sites or facilities exist within the KPPA. Numerous dispersed recreational activities are available throughout the year; however, the number of individuals and amount of recreation time spent in the KPPA are not known. Access to private lands and public lands that require travel across private land is controlled by local landowners. Most BLM-managed lands on the KPPA that are currently open would remain open for public use for the LOP. The Wick Unit is accessible to the public via WGFD, Bear Creek Cattle Company, state, and BLM lands. Windplant development on four sections reserved for permanent public access by the WGFD would represent a prior rights and land status conflict. KENETECH is in the process of exchanging public access easements with the WGFD for release of public access easements on unaffected sections and portions of sections. Areas where public access would be denied for safety reasons include turbine locations and certain ancillary facility sites (e.g., substations). Most (90%) of the employees will be residents of Carbon and Albany Counties, so there is likely to be only a negligible increase in recreation demands from new employees moving into the area.

Construction, noise, dust, traffic, the presence of equipment, and associated human activities would change the character of the area and recreational experiences, such as backcountry hiking and camping, wildlife observation, horseback riding, nature photography, big game hunting, and ORV use. With the application of mitigation measures identified in Section 5.1.3.10, impacts to recreational opportunities due to vegetation or wetland disturbance would initially be moderate and would be negligible for the LOP and beyond. Because visual impacts will be significant in some areas (see Section 4.6), the aesthetic sense of a rural, undeveloped recreational area would be greatly reduced. In addition, areas proximal to turbine locations and other facilities may be avoided by some hunters and may negatively affect hunter recreational experiences. With improved access to the KPPA area, poaching and disturbance

of big game and other wildlife may increase. However, increased accessibility throughout the KPPA area would enhance opportunities for hunting and wildlife observation for some recreational users.

The Windplant may attract tourists to the area. The wind turbines near Medicine Bow were listed in the area's promotional literature, and tourists as well as people from the region have travelled the gravel road to view the structures. The novelty of the Windplant and change from the relatively undeveloped prairie and sagebrush landscape along I-80 will likely cause some travelers to view the area with interest. Interpretive panels may be erected at Arlington, the Wagonhound Rest Area, Elk Mountain, or other locations along area highways to increase tourist interest in the Windplant. A short-wave radio broadcast may be used in the vicinity of the Windplant to educate passing motorists about the project and provide information on viewing and photographing the Windplant.

All surface equipment and structures would be removed during final reclamation. All turbine locations, selected roads, and other disturbed sites would be reclaimed to reestablish grazing lands and wildlife habitat and to restore the area for recreational use. Some roads may be retained upon project completion allowing increased recreational use of the area subject to private landowner permission to use private lands and roads. The 230-kV transmission line would be disassembled and structure locations reclaimed if it would not be used for other purposes after the LOP.

4.5.2.6 Land Status and Prior Rights

KENETECH and PacifiCorp have the appropriate leases to develop throughout the KPPA area, and proposed operations would not infringe on existing KPPA area ROWs or easements; therefore, there would be a negligible impact on prior rights in the KPPA area. Existing power lines and pipelines would be avoided, where practical, during construction. Structures associated with the 230-kV transmission line would be located at least 30 ft (9 m) from existing pipelines, where feasible. Alternates 1, 2, and 3 would cross pipelines at 5, 2, and 5 locations, respectively. The 243 AUMs lost during construction and the reduction of 93 AUMs for the LOP are being compensated for by KENETECH, so there would be a negligible infringement on the rights of grazing permittees. The Wick Unit is accessible to the public via WGFD, Bear Creek Cattle Company, state, and BLM lands and would not be impacted by the Proposed Action.

The WGFD has two permanent public access easements for "recreational" and other purposes on about 2,250 ac of Foote Creek Rim. Windplant development could occupy about 90 ac of these lands, and would not restrict public access to these areas. For the first phase of the project, KENETECH has agreed to acquire an additional access easement on other lands, and will convey that easement to the WGFD in exchange for the release of about 30 ac of existing public access easement on a portion of Foote Creek Rim. Any additional easement exchanges at Foote Creek Rim for subsequent phases would be on lands identified by the WGFD of comparable acreage and value.

4.5.3 Alternative A

Under Alternative A, no significant impacts to land use are anticipated. Impacts to landscape character would be similar to the Proposed Action but could be reduced by approximately 40% from the Proposed Action. It is likely that landscape impacts on Foote Creek Rim would be the same as for the Proposed Action because the wind regime on the Foote Creek Rim area is superior to that on the Simpson Ridge area; therefore Windplant development on the Foote Creek Rim area would probably proceed to or near to the full 200 MW, unless restricted by the BLM due to environmental concerns. Under this scenario, by reducing the overall size of the Windplant to 300 MW, only about 100 MW (275 turbines) would be constructed in the Simpson Ridge area. Assuming that the Simpson Ridge portion would occupy approximately 80 ac/MW, approximately 8,000 ac

would be converted from relatively undeveloped to a primarily industrial character. Alternatively, if construction is prohibited on the Foote Creek Rim area due to environmental concerns (e.g., loss of mountain plover habitat), the 300-MW Windplant would be constructed entirely within the Simpson Ridge area and impacts to the Simpson Ridge landscape would be the same as for the Proposed Action.

The amount of disturbance within the KPPA under Alternative A would be reduced by approximately 40% from that of the Proposed Action. The initial reduction in AUMs under this alternative would be 97 (1% of total AUMs within the KPPA area); LOP reductions would total 37 AUMs (0.5% of the KPPA). Impacts under this alternative would be similar to those for the Proposed Action, and since the same mitigation measures would be applied, impacts would be negligible for the LOP and beyond. Beneficial impacts from increased tourism in the area would be similar to the Proposed Action. Impacts to mineral development, recreation, and prior land rights would be reduced by approximately 40% from the Proposed Action and would be negligible for the LOP.

4.5.4 No Action

No impact would occur to agricultural or recreational land use activities under the No Action Alternative. Mineral development in the KPPA is unlikely, and thus, the No Action Alternative probably would not affect area mineral resources (i.e., these would not be developed immediately to compensate for the lost power). Under the No Action Alternative, landscape character would not change due to the proposed project. The beneficial impacts of enhanced tourism would not be realized.

4.5.5 Cumulative Impacts

Because there are no quantifiable significance criteria for impacts to landscape character, cumulative impacts of Windplant development on landscape character cannot be evaluated in this EIS. However, each successive development in southern Wyoming incrementally decreases the amount of land that is relatively undeveloped, remote, and wild. Huge tracts of land have been used or are being considered for oil and gas development (Map 4.1), coal mining, other mineral development, and reservoirs; and these, coupled with the vast numbers of roads and other ancillary developments, substantially reduce the landscape quality throughout southern Wyoming.

Grazing allotments within and adjacent to the KPPA would not be significantly affected by development operations. The combined existing disturbance (439 ac) plus the proposed 500-MW Windplant would result in a LOP disturbance of 1,787 ac, or approximately 3% of the KPPA. The cumulative effect on grazing in the area by lessees (i.e., loss of forage) is being compensated for by KENETECH. Impacts on grazing from the Proposed Action plus other developments would most likely be negligible.

Moderate land use impacts have occurred in the region due to coal mining in the Hanna Basin. The coal mines north of the KPPA have incrementally disturbed 18,180 ac, 12,439 of which have been reclaimed and 5,741 ac, which are presently disturbed. Assuming that grazing and wildlife uses can begin on reclaimed areas within a few years after reclamation, and that disturbance acreage remains fairly constant, the mines account for the loss of about 5,741 ac of grazing lands and wildlife habitat in any one year. However, during coal mine reclamation, mined-out areas would be restored to approximate pre-mining land uses, including livestock grazing; therefore, no significant cumulative impacts would occur.

Windplant development in combination with other past and reasonably foreseeable future developments would result in a minor increase in demand for and impacts on recreational resources. Operation of the wind turbines would have a minimal cumulative impact due to the small number of people involved in O&M (29 people for the LOP) (Appendix E) and the fact that 90% of the employees would be current residents of

Carbon and Albany Counties. Increased big game displacement may occur (Section 4.2.3.1), which could limit hunting success, and the character of the area could be changed such that dispersed outdoor recreational activities would be reduced; however, an increase in tourism specific to the Windplant is likely. These would be moderate impacts.

Overall, cumulative impacts to land uses within the KPPA would be similar to those associated with the Proposed Action, since the same mitigation measures would be applied. No development would occur on lands subject to the WGFD public access easements until exchanges of those easements are successfully negotiated; therefore, there would be no prior rights or land status violations.

4.6 VISUAL RESOURCES

4.6.1 Significance Criteria

Impacts to visual resources would be considered significant if the proposed development conflicts with the BLM VRM objectives specified in the GDRA RMP (BLM 1987:64). Conflicts would include strong visual contrasts in VRM Class III areas.

4.6.2 Proposed Action

The VRM system uses a Visual Contrast Rating analysis to evaluate visual impacts of a proposed project, and to develop mitigation measures to reduce visual impacts. The degree to which a proposed activity would affect visual quality depends on the contrast between the existing landscape and the proposed development. Contrast is measured by comparing the basic elements of form, line, color, and texture of the existing landscape with the elements introduced by the project. Results of a visual contrast rating of the proposed project within the KPPA (see below) indicate that VRM objectives would be violated in large areas of the KPPA, and thus, visual impacts would be significant.

Visual simulations of the proposed Windplant at 6 KOPs within and adjacent to the KPPA were used to illustrate the visual elements (i.e., form, line, color, and texture) that would be associated with the Windplant (Appendix F, Photographs F.1-F.6). The proposed development primarily would consist of structural features (e.g., turbines, transmission lines, substations) and landform features (e.g., roads and pads). The expected visual characteristics of the proposed development are presented in Table 4.24.

Visual contrast ratings were computed by the BLM at KOPs 1, 2, 3, 4, and 5 (Map 3.24). Neither simulations nor contrast ratings were performed at KOPs 6 and 7. Landscape elements were compared to the elements that would be introduced by the proposed Windplant. A degree of contrast in form, line, color, and texture on landforms/water, vegetation, and structures was assigned to each landscape element as follows:

- none -- the contrast is not visible or perceived;
- weak -- the contrast can be seen but does not attract attention;
- moderate -- the contrast begins to attract attention and begins to dominate the landscape; and
- strong -- the contrast demands attention, will not be overlooked, and is dominant in the landscape.

A strong visual contrast rating would be acceptable in a VRM Class IV area but would not meet the VRM objectives in a VRM Class III area.

The visual contrast ratings for the five KOPs are presented in Table 4.25. Contrasts range from predominantly moderate [KOP 3 (McFadden School)] to predominantly moderate-strong (at the four other KOPs).

Management objectives for VRM Class III areas would be met at KOP 3 and in all Class IV areas (see Map 3.24 for locations of Class IV areas). Management objectives would not be met at KOPs 1, 2, 4, and 5, where strong contrast ratings occur within VRM Class III areas; therefore, significant

Table 4.24 Visual Characteristics of the Proposed Windplant.

Element	Land/Water	Vegetation	Structures
Form	Ridges horizontal	Flat/small clumps of shrubs/few trees	Vertical/narrow
Line	Horizontal/diagonal	Horizontal	Vertical/narrow
Color	Blue/gray/brown/green	Seasonal - green/brown	Carlsbad canyon with white blades (assumed)
Texture	Smooth with drainages	Smooth/small bumps	Clumped/uniform

impacts to visual resources would occur from the Proposed Action for the LOP. Because the landscape and vegetation within the area are predominantly horizontal/flat (Table 4.24) and the WTGs would introduce a strong vertical element into the landscape, the WTGs would create strong contrasts in the form and line of landforms and vegetation (Appendix F, Photographs F.1-F.6).

Visual impacts are greatly reduced with distance from the Windplant (Appendix F, Photographs F.1-F.6). No strong contrasts occur at the McFadden School (KOP 3), which is approximately 4.0 mi (6.4 km) from the proposed Windplant. Based on visual contrast rating results, VRM objectives probably would not be met in Class III areas where turbines are viewed at a distance of 2.5-3.0 mi (4.0-4.8 km) or less. KOPs 1, 2, 4, and 5 were all less than 3.0 mi (4.8 km) from the Windplant as pictured in the photo simulations, and strong contrasts were observed (Table 4.25). No visual contrast rating was completed for KOP 6, in the Simpson Ridge area, but the effects of disturbance on perceived contrast can be readily seen in Photo F.6 (Appendix F). Visual impacts will be greatest for Arlington residents, patrons of the KOA campground, and motorists on highways within and adjacent to the KPPA.

Mitigations for impacts to visual resources caused by Windplant facilities would include locating facilities within seldom-seen areas, where feasible; and painting turbine towers a flat, non-reflective BLM standard color (e.g., Carlsbad Canyon) and the blades a non-reflective white to improve visibility to birds (Section 5.1.3.11). Significant visual impacts would occur at close distances, but this color scheme would cause the WTGs to recede more quickly as viewing distance increases. The turbines, although highly visible, would provide interest for some viewers, especially people traveling through the area. The towers provide a change in scenery from the undeveloped grasslands and sagebrush found for many miles along the highways around the KPPA. This change will likely be viewed as favorable by some and undesirable by others.

Other visual impacts will occur due to land disturbance (e.g., road and pad construction), substation construction, and the erection of overhead collection lines and the 230-kV transmission line. Alternate 3 would be least visible from major highways [only 4.0 mi (6.4 km)]. Alternates 1 and 2 would be visible from highways for 20.0 mi (32.2 km) and 9.0 mi (14.5 km), respectively. Road cuts, pads, overhead lines, and substations, while possibly less visible than the WTGs, typically cause a negative response among viewers. Mitigation measures

Table 4.25 Visual Contrast Rating for 5 KOPs within the KPPA.

Area/KOP/Element	Land/Water Body	Vegetation	Structures
Foote Creek Rim Area			
KOP 1 - 1.5 mi (2.4 km) east on I-80 from Arlington exit			
Form	Moderate	Moderate	Moderate
Line	Moderate	Strong	Moderate
Color	Weak	Strong	Moderate
Texture	Weak	Moderate	Weak
KOP 2 - Arlington KOA campground			
Form	Strong	Strong	Moderate
Line	Strong	Strong	Moderate
Color	Moderate	Moderate	Moderate
Texture	Moderate	Strong	Weak
KOP 3 - McFadden School			
Form	Moderate	Moderate	Moderate
Line	Moderate	Moderate	Moderate
Color	Moderate	Moderate	Moderate
Texture	Weak	Weak	Weak
KOP 5 - 2.0 mi (3.2 km) west of Arlington on I-80			
Form	Strong	Moderate	Moderate
Line	Strong	Strong	Moderate
Color	Moderate	Strong	Moderate
Texture	Weak	Moderate	Weak
Simpson Ridge Area			
KOP 4 - 3.0 mi (4.8 km) north of I-80 on State Highway 72			
Form	Strong	Strong	Moderate
Line	Moderate	Strong	Moderate
Color	Weak	Moderate	Moderate
Texture	Weak	Weak	Weak

would be employed to avoid strong visual contrast ratings for these facilities and would include:

- locating facilities in seldom-seen areas, where feasible;
- minimizing vegetation disturbance;
- minimizing cuts and fills or other topographic alterations;
- prompt reclamation, including reshaping the landscape to its approximate original contour and revegetation with native species;
- minimizing the number of highly visible long linear features (e.g., creating switchbacks in roads on ridges); and
- screening facilities (e.g., planting vegetation screens around substations or prominent road cuts).

4.6.3 Alternative A

Reductions in visual impacts under Alternative A would depend entirely on turbine and other facilities placement within the KPPA. If turbines are placed throughout the KPPA, as was assumed for the Proposed Action, visual impacts would be roughly similar to impacts from the Proposed Action. If, however, turbines are placed in seldom-seen areas, visual impacts could be reduced. Mitigation measures similar to the Proposed Action would be employed, but significant impacts would occur within VRM Class III areas wherever turbines are viewed within 2.5-3.0 mi (4.0-4.8 km).

4.6.4 No Action

Under the No Action Alternative, no significant impact to visual resources would occur.

4.6.5 Cumulative Impacts

Cumulative impacts were evaluated by estimating the total acreage of the KPPA that would be occupied by WTGs within 3.0 mi (4.8 km) (the approximate threshold distance for strong visual contrast ratings) from major roads. Assuming that WTGs would be distributed throughout the Simpson Ridge area, Windplant development would result in a conflict with VRM Class III objectives on approximately 24,192 ac (40%) within the KPPA which constitutes a significant cumulative visual impact (Map 4.3). Although the environmental analysis has not been completed for the proposed Medicine Bow windfarm, portions of the project would likely be in VRM Class III areas; therefore, development would constitute a significant visual impact. Moderate impacts caused by new and existing roads and other developments would also occur throughout the KPPA. The character of the large portions of the KPPA would change from rural and undeveloped to a predominantly industrial landscape. The principal mitigation for these cumulative impacts would be placing turbines and new roads in seldom-seen areas away from major roads, where feasible.

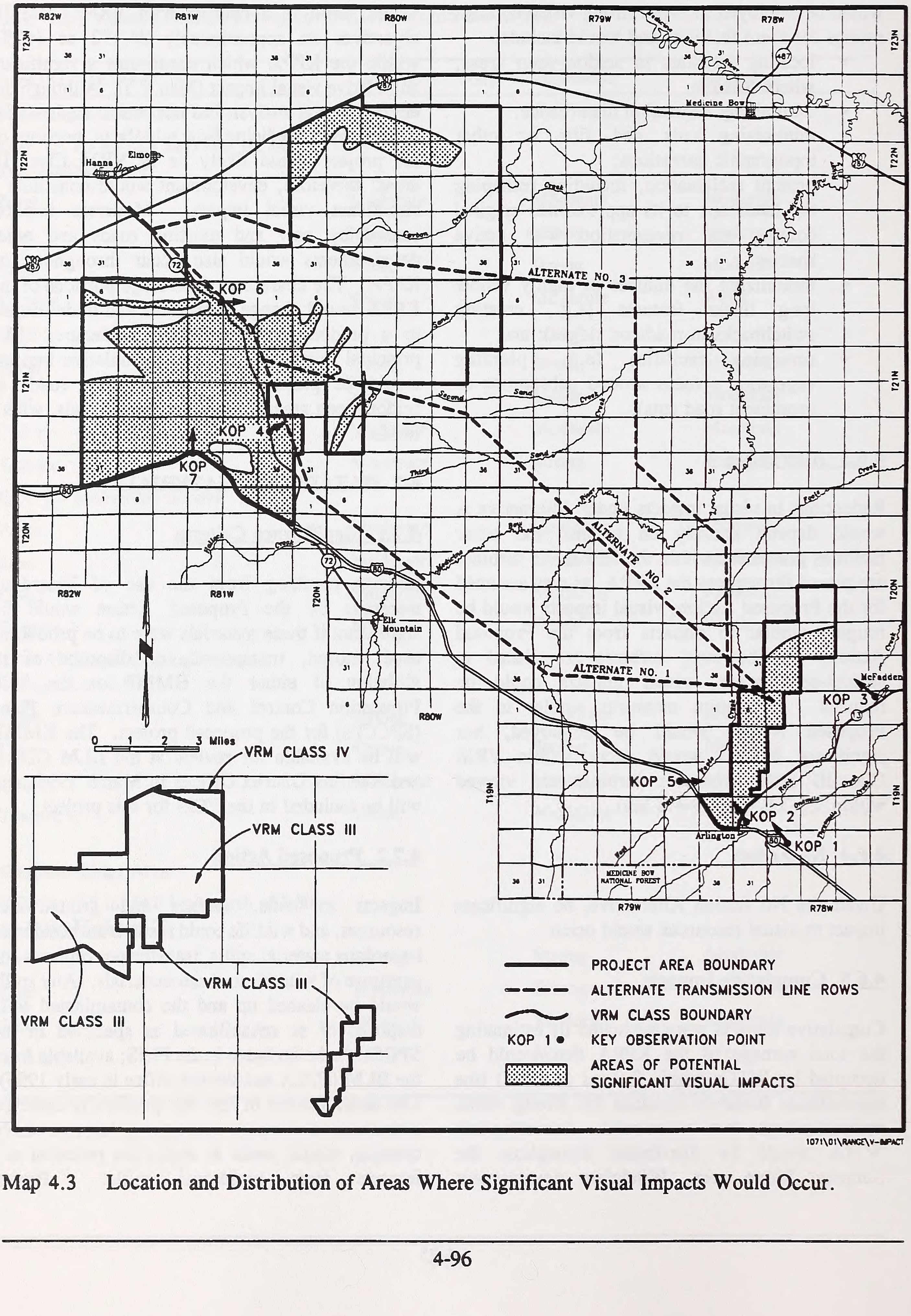
4.7 HAZARDOUS MATERIALS

4.7.1 Significance Criteria

Impacts resulting from the use of hazardous materials by the Proposed Action would be significant if these materials were to be produced, used, stored, transported, or disposed of in violation of either the HMMP or the Spill Prevention Control and Countermeasure Plans (SPCCPs) for the proposed project. The HMMP will be available for review at the BLM GDRA and Rawlins District Offices in March 1995, and will be included in the FEIS for this project.

4.7.2 Proposed Action

Impacts to soils, surface and groundwater resources, and wildlife could result from accidental hazardous material spills, transformer ruptures, or exposure of wildlife to these materials. Any spills would be cleaned up and the contaminated soils disposed of or rehabilitated as specified in the SPCCP (to be included in the FEIS; available from the BLM GDRA and district office in early 1995). The small amount of soil that potentially could be contaminated, coupled with appropriate and timely cleanup, would result in negligible potential soil impacts from accidental spills. Proper



Map 4.3 Location and Distribution of Areas Where Significant Visual Impacts Would Occur.

containment of oil and fuel in storage areas and location of facilities away from drainages would limit potential surface and groundwater contamination to negligible levels.

Since project operations would comply with all relevant federal and state laws regarding hazardous materials and with directives identified in the HMMP and the SPCCP for this project, no significant impact is anticipated.

4.7.3 Alternative A

The potential for hazardous material impacts under Alternative A would be reduced by approximately 40% from that of the Proposed Action. Since the same mitigation measures would be applied, no significant impact is anticipated.

4.7.4 No Action

Under the No Action Alternative, there would be no new impact from hazardous materials since no additional hazardous materials would be produced, used, stored, transported, or disposed of as a result of the project.

4.7.5 Cumulative Impacts

All existing oil and gas development projects within the KPPA use mitigation measures similar to or more stringent than those described for the Proposed Action to prevent soil contamination, surface and groundwater pollution, and wildlife exposure; therefore, impacts are expected to be negligible. The proposed Medicine Bow windfarm would probably use materials similar to those for the proposed Windplant (Section 3.7), and by employing similar mitigation measures, would not contribute substantially to cumulative impacts. None of the other developments within the KPPA involve the generation, storage, use, or transportation of hazardous materials; therefore there should be no additional cumulative impact.

4.8 UNAVOIDABLE ADVERSE EFFECTS

The mitigation measures incorporated in the project description throughout the preceding discussion of impacts and in Chapter 5.0 would avoid or minimize many of the potential adverse effects. However, not all adverse effects can be avoided, nor is mitigation 100% effective in remediating all impacts. There would be at least a minimal amount of unavoidable adverse impact on all resources present in the KPPA for at least a short time, due to the presence of equipment and humans in the area and the time necessary for mitigation (e.g., reclamation) to be effective. Significant unavoidable impacts associated with the project would include incidental taking of migratory and/or T&E birds without procurement of permits to allow such takings (Sections 4.2.3.3-4.2.3.4) and significant visual impacts associated with WTGs located in VRM Class III areas (Section 4.6). At this time it is unknown whether significant unavoidable impacts to cultural resources (i.e., sites with Native American significance) would occur (Section 4.3).

4.9 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible and irretrievable impact is defined as a permanent reduction or loss of a resource that, once lost, cannot be regained. Most energy development projects (e.g., coal, oil, gas) result in an irreversible and irretrievable commitment of the power-generating resource (e.g., fossil fuels). Wind is a renewable resource that would not be depleted by the proposed project and would offset the need to consume fossil fuels.

The primary irreversible and irretrievable commitment of resources would be loss of individual birds via collisions with WTGs or other Windplant facilities. Animals killed during earth-moving activities or through collisions with vehicles are irreversibly and irretrievably lost. Also, loss of habitat by wildlife that are displaced by the Windplant O&M activities may be an irreversible and irretrievable loss.

Soil lost through wind and water erosion would be an irreversible and irretrievable loss from the KPPA.

The loss of productivity (i.e., forage, wildlife habitat) from lands devoted to project activities (i.e., WTG locations, roads) would be an irreversible and irretrievable commitment during the time that those lands are out of production and until they are successfully revegetated. Most of the land would be returned to production after reclamation and revegetation; however, the vegetation community may take more than 20 years after the LOP to recover.

Inadvertent or accidental destruction of paleontologic or cultural resources during construction would be an irreversible and irretrievable loss, but it is not likely to be a significant impact since archaeological and paleontologic data recovery and monitoring activities would be conducted as deemed appropriate by the BLM.

There would be an irreversible and irretrievable commitment of the energy used during construction, drilling, production, and reclamation associated with the proposed project. Foundations or other facilities greater than 6 inches (15 cm) below ground surface would be permanent and abandoned in place. They cannot be recovered due to practical or economic considerations, so they would be irreversibly and irretrievably committed. If the 230-kV transmission line would be used for other purposes after the LOP, this would be considered a permanent facility.

4.10 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

For the purposes of this discussion, short-term use of the environment is that use during the LOP, and long-term productivity refers to the period after the project is completed and the area reclaimed.

The short-term use of the environment would affect the resources as discussed in Sections 4.1 through 4.7 above. This use and the associated impacts would not significantly affect the long-term productivity of the KPPA or adjacent areas. After the project is completed and disturbed areas reclaimed, the same resources that were present prior to the project would be available. Because wind is a renewable resource, there would be no short- or long-term loss of this power-generating resource. It may take 20 years or more after the LOP for some of the reclaimed areas to revegetate; however, reclamation would provide conditions to support wildlife, livestock, and recreation. Use of the KPPA during the LOP would not preclude the subsequent long-term use of the area for any purpose for which it was originally suited prior to the project.

5.0 MITIGATION AND MONITORING

The mitigation and monitoring measures identified in this chapter are a recapitulation of measures presented in Section 2.1.11 and Chapter 4.0. Measures were developed in response to impacts identified in Chapter 4.0 and during the scoping process. Mitigation and monitoring measures describe how project activities would be implemented to assure compliance with federal, state, and local laws, resource management goals and objectives for the KPPA, applicable ROW stipulations, and additional environmental protection goals identified in Interdisciplinary Team (IDT) analyses. All mitigation and monitoring measures identified in this chapter would be applied to the Proposed Action or Alternative A. Mitigation and monitoring for Phase I would be the responsibility of KENETECH and PacifiCorp; other entities may own all or parts of future phases and would be responsible, along with KENETECH, for mitigation and monitoring.

The BLM GDRA Manager would be the AO for the proposed project. Mitigation and monitoring measures identified in this chapter may be modified by the AO based on new information or to further minimize impacts. IDT recommendations would be developed during field site analyses conducted during POD reviews and presented to the AO. Final mitigation and monitoring requirements would be determined by the AO.

Authorization to proceed with the implementation of this project on public lands would be contingent on receiving a completed POD from KENETECH and PacifiCorp and USFWS concurrence on the T&E species impact analysis. The POD for the first phase of development will be completed prior to issuing the FEIS for this project. Approval of the first phase POD will be contingent on the environmental analysis presented in the EIS and POD (see Section 2.1.2). Approval of subsequent phases would be contingent on completion and acceptance of future PODs.

The POD for each phase or each new transmission line would contain a construction schedule and detailed location maps which the AO, in consultation with other agency personnel (e.g., WGFD, WDEQ, USFWS), would approve on a case-by-case basis. This action would allow project activities to proceed in areas and/or during periods of restriction if deemed appropriate by the AO (e.g., during mild winters in crucial winter range or near abandoned raptor nests during the nesting season). Exceptions would be granted only in cases where adherence to ROW or POD stipulations is not possible or necessary and the Proposed Action is acceptable with proper mitigation. Public review of ROW or POD stipulation modification, waiver, or exception may be granted when deemed appropriate by the AO. ROW and POD stipulations may provide further mitigation and monitoring criteria that have not been identified in this EIS.

Reclamation plans would be provided as components of PODs according to guidelines established by the BLM. The reclamation plans would detail all practices necessary for reclamation on areas initially disturbed during construction that would not be required for the operation of the Windplant (e.g. staging areas along the transmission line route). Plans would include configurations of the reshaped topography and drainage systems, segregation and protection of topsoil, surface manipulations, waste disposal practices, soil treatments, and seed mixtures, and would incorporate the material applicable to reclamation presented in Chapters 2.0 and 4.0. A schedule for commencement and completion of reclamation operations would also be included. Similar reclamation plans would be prepared upon abandonment of all facilities.

Mitigation and monitoring measures identified would be adhered to on both federal lands and private lands affected by federal undertakings, subject to landowner preference or agreements.

5.1 MITIGATION MEASURES

5.1.1 Administrative Requirements

All phases of the Proposed Action would be conducted by KENETECH, PacifiCorp, other future Windplant owners, and their contractors in full compliance with all applicable federal, state, and local laws and regulations and within the guidelines specified in the approved ROW easement and PODs.

5.1.2 Preconstruction Planning and Design

The final location of each development site would be evaluated in the POD for each phase. Site-specific recommendations and mitigations would be developed by KENETECH, PacifiCorp, other Windplant owners, and the BLM or other landowners. Any proposed activity or surface disturbance would be accompanied by appropriate engineering design specifications, geotechnical analyses, mitigation plans, etc. This information would be of sufficient detail to demonstrate that all environmental resources would be adequately protected or that impacts to them would be adequately mitigated, consistent with the information presented in this EIS.

The following areas or situations may require more detailed or complex designs, plans, or analyses:

- slopes in excess of 25%;
- areas within 500 ft (152 m) of surface water and/or wetland areas;
- areas within 100 ft (31 m) of ephemeral or intermittent drainages;
- areas on unstable soils;
- construction when soils are frozen or saturated or when watershed damage is likely to occur;
- construction activities in crucial wildlife habitats (e.g., crucial winter range during critical winter periods); and
- construction at sites where cultural or paleontological resources are known to be present.

All sources of aggregate for construction materials would be identified by KENETECH, and the appropriate surface management agency (BLM, State of Wyoming) would approve the sources and times of extraction.

5.1.2.1 Transportation Plan

Preliminary road design plans are addressed in Section 2.1.4.1. Existing roads in the KPPA would be considered first for use as collector, local, and resource roads. These roads would be utilized whenever feasible in lieu of new construction because the BLM will not foster the proliferation of separate ROWs or perpetuate duplicate road systems on public lands. A preliminary road plan for the Foote Creek Rim area is shown on Map 2.1. Standards for road design would be consistent with BLM road standards (BLM 1985, 1991), and a BLM District Engineer would approve road design plans.

Individual road design plans for new and/or improved roads would be submitted for approval as components of the PODs. KENETECH, PacifiCorp, and other Windplant owners would schedule a review of plans with sufficient time to obtain BLM approval prior to commencement of work. Additionally, all project-related roads on public lands not required for project O&M or existing area activities would be recontoured, reseeded, and permanently blocked, where feasible. Roads on private lands would be similarly treated, subject to landowner preference or agreement.

KENETECH, PacifiCorp, and other Windplant owners would be responsible for necessary preventative and corrective road maintenance for the LOP. Maintenance responsibilities may include, but are not limited to, blading, gravel surfacing, cleaning ditches and drainage facilities, dust abatement, noxious weed control, or other requirements as directed by the AO. Windplant owners and operators are required to develop joint road use agreements designating road development, maintenance, and use requirements by area users. The road use agreements would

identify responsibilities for necessary preventative and corrective road maintenance throughout the LOP.

5.1.2.2 Hazardous Material Containment

Notice of hazardous material spills or leakage (i.e., undesirable event) would be immediately given by KENETECH, PacifiCorp, or other Windplant owners to the AO and other such federal and state officials (e.g., WDEQ) as required by the Clean Water Act [40 C.F.R. Parts 110, 112, 125(k)], and other applicable state and federal laws. Any oral notice would be given as soon as possible, but within 24 hrs, and oral notices would be confirmed in writing within 72 hrs.

All project activities would be in compliance with the HMMP for this project and Windplant owners' SPCCPs (to be provided with each POD). The HMMP will be available for review at the BLM GDRA and Rawlins District Offices in early 1995, and the plan will be presented in an appendix to the FEIS for this project.

5.1.2.3 Stormwater Pollution Prevention Plans

KENETECH, PacifiCorp, and other Windplant owners would prepare the WDEQ-WQD SPPPs for activities requiring disturbances of greater than 5 ac. These plans will identify best-management practices, including erosion and pollution control procedures that would be implemented throughout the LOP to minimize surface water pollution. An SPPP would accompany the POD for each phase.

5.1.3 Resource-specific Requirements

5.1.3.1 Climate and Air Quality

Climate. Mitigations for snow accumulation impacts include, but are not limited to:

- locating WTGs away from snow accumulation areas, where feasible;
- incorporating downtower boxes into the tower itself or locating them on the downwind side of tower bases;
- surrounding transformers with shields or turbulence generators to disperse blowing snow;
- locating access roads on the upwind side of WTGs, if feasible;
- if it is not possible to locate roads on the upwind side of WTGs, locating roads a minimum of 105 ft (32 m) from transformers;
- minimizing fencing;
- using wing-type plows for snow removal, rather than blades.

Proper road design is the most important mitigation for minimizing impacts of the proposed project on snow distribution. For highway design, the recommended embankment height, H_e (m), above grade is given by (Tabler 1994a): $H_e = 0.4S + 0.6$, where S is average snowfall (m) over the snow accumulation season. For the project area, snowfall averages 7.9 ft (2.4 m), and therefore, the recommended embankment height would be 5.1 ft (1.56 m). Low-growing vegetation, strong winds, and less stringent standards would allow a somewhat lower embankment height to be used for service roads (which would also minimize overall disturbance due to roads).

Primary access roads would be located to avoid natural snowdrift areas. Cut sections would be designed to minimize drift encroachment on the roadway, using the general guidelines presented by Tabler (1994a), as appropriate. Where feasible, roads would be located and designed to obviate the need for snow fences which could reduce power output from the project and affect hydrology, soils, geologic hazards, vegetation, and wildlife.

Air Quality. Mitigations for air quality would include regular maintenance of internal combustion engines to keep them in good working condition, dust abatement on gravel roads and construction areas, and prohibition of open burning of refuse.

5.1.3.2 Topography

Site selection to avoid, where feasible, steep slopes, rugged topography, and perennial, intermittent, and ephemeral drainages and to minimize the area disturbed are the measures for reducing impacts to topography.

5.1.3.3 Minerals

The loss of access to potential mineral resources would be mitigated by avoiding areas of known accessible reserves, where feasible. If coal, oil, gas, or other mineral development within the KPPA becomes economical in the future, additional mitigations may be recommended by the BLM.

5.1.3.4 Geologic Hazards

Windplant facilities would be designed to UBC Zone 4 standards, which should be more than adequate to withstand the types of earthquakes that would typically occur in Carbon County. The probability of a severe earthquake occurring during the LOP is negligible.

Activities within potential landslide areas or on slopes greater than 25% would be avoided, where feasible. Unavoidable disturbance of these areas would be reviewed on a site-specific basis by the BLM during the POD/NTP process.

To mitigate potential impacts caused by flooding, construction in flood-prone areas would be limited to late summer, fall, or winter, when conditions are generally dry and streamflows are low. Additional mitigation to lessen any impact from flooding or high flows would include avoidance of areas with high erosion potential (i.e., steep slopes, floodplains, unstable soils); reestablishment of existing contours, where feasible; avoidance of areas within 500 ft (152 m) of open water and 100 ft (31 m) of ephemeral/intermittent drainage channels where feasible; and implementation of appropriate erosion and sediment control and revegetation procedures as identified in the PODs.

Windblown deposits would be avoided, where feasible, and areas necessarily disturbed would be seeded as soon as practical using an appropriate seed mixtures. If deemed appropriate by the BLM, disturbed areas would be mulched or otherwise protected to prevent wind erosion and facilitate successful reclamation. Specific measures would be detailed in the PODs.

5.1.3.5 Paleontologic Resources

The potential paleontologic value of construction sites would be assessed by BLM personnel during preconstruction surveys. Paleontologic surveys of disturbance areas would be conducted as determined by BLM to ensure that significant paleontologic resources are avoided or recovered prior to construction. If monitoring during construction is necessary, a BLM-qualified paleontologist would be required to be on-site during construction to mitigate direct and indirect impacts to significant paleontologic resources. Paleontologic surveys, data recovery, and monitoring would be conducted in accordance with BLM guidelines (BLM 1993b).

Any paleontologic resource discovered on public land by KENETECH, PacifiCorp, or other Windplant owners, or any person working on their behalf, would be immediately reported to the AO. Owners/operators would immediately suspend all operations at the site until authorization to proceed is issued by the AO. An evaluation of the discovery would be made by the AO to determine appropriate actions to prevent the loss of significant resources. KENETECH, PacifiCorp, or other Windplant owners would be responsible for the cost of evaluation, and any decision as to proper mitigation measures would be made by the AO after consulting with owners/operators.

5.1.3.6 Soils

The principal mitigation for adverse impacts to soils would be to minimize disturbance wherever feasible. Other mitigation measures would include, but not be limited to:

- leaving soils intact (removing vegetation only) during power line construction;
- avoiding construction at times when soils are frozen, whenever feasible;
- avoiding areas with high erosion potential (e.g., unstable soils, windblown deposits, slopes greater than 25%, floodplains), where feasible;
- selectively salvaging topsoil from disturbed areas, protecting topsoil stockpiles from wind and water erosion, and returning topsoil to regraded surfaces during reclamation;
- using appropriate erosion and sedimentation control techniques including, but not limited to, diversion terraces, riprap, and matting; and
- promptly revegetating disturbed areas using approved species.

In some areas, soils exposed during construction may require protection from erosion (e.g., soils with severe erosion potential). Temporary erosion control measures such as temporary vegetation cover; application of mulch, netting, or soil stabilizers; and/or construction of barriers may be used to minimize erosion in these areas prior to permanent reclamation. Specific problem areas would be identified during POD preparation, and site-specific mitigation measures (i.e., the design and placement of check dams, riprap, etc.) would be specified in the PODs.

Grading and landscaping would be used to reduce slopes created by cut-and-fill construction to maximum grades of 3 (horizontal):1 (vertical) on surfaces to be reclaimed, wherever feasible. Regraded slopes would conform, as much as is feasible, with the existing topography. Waterbars would be installed on disturbed slopes, where necessary, to divert runoff. Erosion control efforts would be monitored by the BLM, KENETECH, PacifiCorp, and other Windplant owners and augmented as necessary to control erosion.

Soils compacted during construction would be ripped and tilled as necessary to prepare a suitable seedbed. Cut-and-fill sections on all roads and along power lines would be revegetated with indigenous or BLM-approved species.

Any accidental soil contamination by spills of petroleum products or other hazardous materials would be cleaned up and the soil disposed of or rehabilitated as specified in the SPCCPs to be included in the PODs.

5.1.3.7 Water Resources

Disturbance in the vicinity of streams [500 ft (152 m) of perennial streams or 100 ft (31 m) of ephemeral/intermittent streams] would be avoided, where feasible, or minimized. Culverts would be installed at all appropriate locations as specified in *Manual 9112-Bridges and Major Culverts* (BLM 1984) and *Manual 9113-Roads* (BLM 1985, 1991). Streams would be crossed perpendicular to flow, where feasible, and all stream crossing structures would be designed to carry the 25-year discharge event or other capacities as directed by the BLM.

KENETECH, PacifiCorp, and other Windplant owners would ensure that state and federal water quality standards would not be exceeded. To accomplish this goal, appropriate erosion control measures and timely revegetation of disturbed areas would be implemented. Erosion-prone or high salinity areas would be avoided where feasible, and necessary construction in these areas would be done in the late summer, fall, and winter to avoid peak runoff periods. Proper containment of fuels, transformer oil, and lubricants and the location of staging areas away from drainages would prevent potential contaminants from entering surface waters.

Prudent use of erosion control measures described in Section 5.1.3.6 would be employed as necessary. Interceptor dikes would be used to control surface runoff generated along turbine strings, and dike location and construction methods would be described in the PODs for each phase. If necessary to reduce suspended sediment loads and remove potential contaminants, KENETECH, PacifiCorp, and other Windplant owners would

treat diverted water in detention ponds prior to release into undisturbed vegetated land or into an established drainage. Prior to discharge, water would be treated or filtered, if necessary, to reduce contaminant levels and/or reduce suspended particles to meet applicable state or federal standards. If water is discharged into an established channel, the rate of discharge would not exceed the capacity of the channel to convey the increased flow. Waters that do not meet applicable state or federal standards would be evaporated, treated, or disposed of at an approved facility. SPPPs would be prepared as necessary.

Few, if any, groundwater impacts would occur due to the Proposed Action; therefore, no groundwater mitigations would be necessary.

5.1.3.8 Noise and Odor

All engines required for project activities would be properly muffled and maintained. All WTGs would be properly maintained to prevent excessive turbine noise. Construction and O&M activities would be limited during nighttime hours in the vicinity of residences, on crucial big game ranges during critical winter periods, proximal to active raptor nests during the nesting period, and adjacent to sage grouse breeding areas. Road use specifications designed to keep traffic to a minimum as identified in site-specific transportation plans would further reduce noise impacts.

No mitigation specifically designed to reduce project odors would be applied.

5.1.3.9 Electric and Magnetic Fields

No mitigation specifically designed to reduce EMFs would be applied. Fiberglass rotors would be used to prevent interruption of TV or radio signals.

5.1.3.10 Vegetation

Removal and disturbance of vegetation would be minimized through construction site management (e.g., using previously disturbed areas and existing easements, limiting equipment/materials storage yards and staging areas). Turbine corridors and associated overhead power lines would be located to avoid and/or minimize impacts in areas of high value (i.e., sensitive plant habitats, wetlands, riparian areas). Minimal vegetation removal would be employed during transmission line construction.

Revegetation using a BLM-approved seed mixture containing grasses, forbs, and shrubs (Table 5.1) would begin in the first appropriate season following disturbance. Vegetation removed would be replaced with plants of equal value using procedures that include, but are not limited to:

- fall reseeding (September 15 to freeze-up), where feasible;
- spring reseeding (prior to April 15) if fall seeding is not feasible;
- deep ripping or discing of compacted soils prior to reseeding;
- surface pitting/roughening prior to reseeding;
- utilization of BLM-approved introduced/adapted species (e.g., crested wheatgrass) in the seed mix on selected areas and if attempts at vegetation establishment with native species are unsuccessful;
- appropriate, BLM-approved weed control techniques;
- broadcast or drill seeding, depending on on-site conditions; and
- fencing of certain specific reclamation sites (e.g., riparian areas, steep slopes, areas where grazing may affect reclamation success) as determined necessary by the BLM.

Recontouring and seedbed preparation would occur immediately prior to reseeding unused portions of turbine string corridors, approximately 12.0 ft (3.7 m) on either side of the road ROWs, and the entire disturbed area along transmission line and overhead distribution/ communications line ROWs. Reclamation would be monitored by the BLM annually or as specified in PODs to determine and

Table 5.1 List of Plant Species Suitable for Use in Revegetating Disturbed Areas.

Growth Form	Alkaline Soil Species	Non-Alkaline Soil Species
Grasses	Alkali sacaton	Bluebunch wheatgrass
	Sand dropseed	Thickspike wheatgrass
	Bottlebrush squirreltail	Slender wheatgrass
		Western wheatgrass
		Basin wildrye
		Sandberg bluegrass
		Needle-and-thread grass
		Crested wheatgrass (introduced)
		Russian wildrye (introduced)
Forbs	Scarlet globemallow	Scarlet globemallow
	Onion springparsley	Onion springparsley
	Desert parsley	Desert parsley
	Hoods phlox	Aster
	Prairie onion	Prairie onion
	Englemann daisy	Plains wallflower
	Evening primrose	Fleabane
		Englemann daisy
		Wild buckwheat
		Phlox
		Evening primrose
		Lewis flax
		Penstemon
Shrubs	Spiny hopsage	Common winterfat
	Gardner's saltbush	Antelope bitterbrush
	Shadscale saltbush	Greasewood
	Fourwing saltbush	Birdfoot sagebrush
		Big sagebrush

ensure successful soil stabilization and establishment of vegetation cover.

KENETECH, PacifiCorp, and other Windplant owners would be responsible for implementation of a noxious weed control program in cooperation with the BLM and Carbon County. Weed-free certification by county extension agents would be required for grain, straw, or hay used for mulching revegetated areas.

Windplant owners/operators would minimize disturbance of wetland and riparian areas by providing a 500-ft (152-m) vegetation buffer between disturbances and wetlands, where feasible. Established crossings or temporary bridges would be utilized, where feasible, and all staging areas would be placed away from wetlands. Avoidance of wetlands would be a primary objective.

Where wetland areas must be crossed, as determined during site-specific POD preparation, the primary objective would be soil stabilization through the reestablishment of vegetation cover by native species. Exact procedures and species used would be dependent on site-specific objectives. Compliance with Executive Orders 11988 (floodplain protection) and 11990 (wetland protection) would be assured through consultation with the COE, and during the associated Section 404 permitting process.

Further mitigations for disturbed wetland areas include, but are not limited to:

- limiting development of crossing to periods of only dry conditions (i.e. late summer, fall, winter);
- restoring areas to preproject conditions to the extent feasible, and compacting soils to reestablish impermeability, if impermeable soils contributed to wetland formation;
- selectively salvaging, stockpiling, and replacing wetland topsoils to facilitate the reestablishment of functional wetlands; and
- recontouring and seeding banks with BLM-approved, adapted species in the first appropriate season after construction to facilitate soil stabilization.

5.1.3.11 Wildlife and Fisheries

Big Game. Windplant facilities (e.g., turbine towers, roads, transmission lines) would be placed to minimize or avoid disturbance in areas with high value wildlife habitat (e.g., crucial ranges, wetlands, riparian areas).

WTGs and associated downtower structures would not be placed in big game crucial range if it is economically feasible to construct them in noncrucial habitat. If this is not feasible, construction activities on big game crucial winter and crucial winter/yearlong ranges would be curtailed during critical winter periods (i.e., November 15 through April 30) unless exceptions are arranged with the BLM. KENETECH would schedule construction programs so that proposed facilities located within crucial ranges would be constructed and/or installed during spring, summer, and fall.

During the winter, escape openings would be provided along access roads in big game crucial ranges as designated by the BLM and WGFD to facilitate exit of big game animals from snowplowed roads. Some roads within the KPPA may be closed (i.e., gated and locked) to deny unauthorized access during critical winter periods. To minimize displacement and stress of animals, KENETECH would instruct workers and contractors to avoid unnecessarily stopping and/or exiting their vehicles, especially in big game winter habitat while there is snow on the ground. Additional on-site mitigation measures within crucial winter ranges (e.g., various habitat improvement practices) may be required by the BLM for phases subsequent to Phase I to compensate for unavoidable loss of crucial winter range.

Windplant substations would be fenced to prevent big game and livestock access. All construction and maintenance vehicles would be muffled to

minimize engine noise levels and subsequent disturbance to wildlife.

To minimize wildlife mortality due to vehicle collisions, KENETECH would advise project personnel regarding appropriate speed limits on the KPPA, and roads would be reclaimed as soon after they are no longer required, as feasible. In addition, project-related travel would be restricted to that necessary for efficient project operation on roads located in big game crucial ranges during critical winter months and mountain plover nesting areas during the nesting season to minimize stress on wildlife. Potential increases in poaching would be minimized through employee and contractor education regarding wildlife laws.

Raptors. As information from current research and future monitoring becomes available, WTGs and associated facilities would be designed and located to minimize raptor mortality. Current KENETECH-sponsored research into avian-turbine interactions is focused on three areas: 1) visual and auditory stimuli most effective in improving raptor recognition of WTGs as obstacles; 2) raptor (avian) evasive behavior in an operating Windplant; and 3) dynamics of a golden eagle population in California (i.e., Altamont Pass) (KENETECH 1994). Other research evaluating the influence of WTG characteristics (e.g., upwind vs. downwind orientation) and topographic features on WTG-induced raptor mortality is also being conducted. For example, research is being conducted to determine if turbines with a larger rotor diameter are associated with higher raptor collision rates than turbines with a smaller rotor diameter. It is anticipated that many years of additional research will be required before the relationship of WTG characteristics and raptor mortality can be conclusively determined. Research at Windplants in California suggests that WTGs mounted on tubular towers are associated with lower raptor mortality rates than those mounted on lattice towers; therefore, KENETECH has proposed to use modified tubular towers in the Proposed Action; they would also be used under Alternative A.

Avian task force research results would be used to design and improve mitigation measures to reduce avian mortality at KENETECH's windpower projects nationwide, as well as within the KPPA. Furthermore, the results of this research, combined with site-specific field data collected within the KPPA have been used to design an intensive monitoring program (Appendix B) to be implemented with the construction of each phase. The monitoring program would help determine project impacts on raptors and other birds, and would also assist in the development of effective and appropriate mitigation measures for future phases as the project proceeds.

Activities near active raptor nests (nests known to have been used within the last three years) would be prohibited within a 0.75-mi (1.21-km) radius or other distance as deemed appropriate by the BLM to avoid disturbing birds during the nesting season (February 1 through July 31). If areas adjacent to active raptor nests must be disturbed during construction, project activities would occur outside the nesting season. Mitigation for raptor nests for phases subsequent to Phase I would be designed on a site-specific basis in consultation with the BLM, USFWS, and WGFD. KENETECH would notify the BLM immediately if raptors are found nesting on project facilities.

Other mitigation measures for raptors within the KPPA include, but are not limited to:

- implementation of suggested practices for raptor protection on power lines (Olendorff et al. 1981);
- marking ground wires on power lines, if necessary (Beaulaurier 1981; Beaulaurier et al. 1984);
- placing WTGs, roads, and power lines away from raptor high-use areas (e.g., areas with high concentrations of nests, foraging areas) as stipulated in the PODs; and
- following suggested disturbance buffers for wintering raptors (Holmes et al. 1993).

Opportunities to introduce experimental design into post-Phase I phases of development would allow

testing the effectiveness of proposed mitigations. For example, various rotor color schemes may be used within the Windplant to evaluate the effects of turbine blade color and pattern on raptor mortality rates. Other potential environmental impacts resulting from such experimental designs (e.g., increased impacts to visual resources) would be evaluated, to the extent necessary, prior to implementing mitigations for raptors.

Upland Game Birds. No activity or surface disturbance would be allowed within 0.25 mi (0.40 km) of a sage grouse lek center or a known nest site at any time. To protect probable sage grouse nesting habitat, no construction activities would be allowed within 2.0 mi (3.2 km) of lek between March 1 and June 30 unless exceptions are granted by the BLM. Project activities other than those required for O&M along existing roads within 0.25 mi (0.4 km) of known nests would be curtailed during the period from 1 hr before daylight to 9:00 am from March 1 through April 30. Collection and transmission line poles located within 0.25 mi (0.40 km) of sage grouse leks would be equipped with raptor antiperching devices to minimize the opportunities for raptors to prey on sage grouse.

Waterfowl, Shorebirds, Waders, and Passerines. Waterfowl, shorebird, wader, and passerine mortality would be minimized using the same mitigation methods discussed above for raptors. When feasible, WTGs and other facilities would be placed in locations and configurations that minimize avian mortality. Other mitigation measures [e.g., marking of ground wires on transmission lines (Beaulaurier 1981; Beaulaurier et al. 1984)] would be employed where feasible and appropriate. Monitoring of avian mortality on the KPPA would be implemented beginning with the first phase of development to determine project impacts on avifauna and to develop further mitigation measures, if needed.

Amphibians and Reptiles. No mitigation specifically designed to reduce project odors would be applied.

Fisheries. Potential impacts to fisheries would be minimized by using proper erosion control techniques (see Sections 5.1.3.6-5.1.3.7). Windplant construction within 500 ft (152 m) of open water and 100 ft (31 m) of intermittent and ephemeral channels would be avoided where feasible, and stream crossings would be constructed during the period of lowest flow (i.e., late summer and fall). If streambed crossings are necessary, they would occur perpendicular to flow, where feasible.

5.1.3.12 Threatened and Endangered/State Sensitive Species

Mammals. To minimize surface disturbance, prairie dog colonies crossed by transmission lines would not be bladed and staging areas would be located outside of prairie dog colonies. Raptor antiperching devices would be installed on transmission line poles within prairie dog colonies in the KPPA to eliminate perching opportunities for raptors that might prey on black-footed ferrets. In the unlikely event that black-footed ferrets are discovered in the project area, the USFWS, WGFD, and BLM would be consulted to determine the specific procedures necessary to protect the animals under the guidelines established for the reintroduced experimental population. Black-footed ferret clearance surveys may be conducted if ferrets were discovered and sufficient potential ferret habitat would be disturbed in subsequent phases of the project.

Birds. In the event that bald eagle roosting areas are found, a no surface occupancy restriction would be applied to a 1.0-mi (1.6-km) buffer zone around winter roosts, and the area would be closed to surface-disturbing activities (e.g., construction, drilling) from November 1 through April 1. If active bald eagle or peregrine falcon nests are found, no activity or surface disturbance would be allowed for up to a 1.0-mi (1.6-km) buffer zone around nests or active nests on artificial structures between February 1 and July 31.

If WTG and/or associated facility construction is planned between April 1 and July 31, a survey for

mountain plover nests (and/or defending pairs of adult mountain plovers) would be conducted within 656 ft (200 m) of the area to be disturbed. If an active mountain plover nest is located within the search area, no construction activity would be allowed until after July 31. Standard raptor mitigations (see Section 5.1.3.11) would be applied to construction areas near ferruginous hawk nests, as well as for ferruginous hawk nests built on project structures or active nests on artificial structures. Habitats in which state sensitive species are likely to occur would be avoided where feasible.

A BA for the proposed project assessing project impacts to T&E and candidate plant and animal species is currently being prepared. Copies of the BA will be available for review in early 1995 at the BLM GDRA and Rawlins District Offices.

Mitigation for T&E plant species would include, but not be limited to:

- surveying areas to be disturbed prior to disturbance,
- avoidance of known T&E populations, and if avoidance is not feasible,
- other mitigation approved by the USFWS and the AO.

5.1.3.13 Cultural and Historic Resources

Impacts to cultural resources would be mitigated following procedures specified in 36 C.F.R. 800. Class I and Class III inventories would be conducted on all federal and state lands and on private lands affected by federal undertakings. Cultural sites identified during those inventories would be avoided, where feasible. Areas adjacent to perennial water and aeolian deposits also would be avoided, where feasible. Mitigation measures would be determined by BLM in consultation with the SHPO; the ACHP; appropriate Native American tribes; KENETECH, PacifiCorp, and other Windplant owners. If a large number of sites cannot be avoided, a programmatic agreement among the aforementioned parties may be developed.

An ethnohistoric study of Foote Creek Rim is currently being conducted to determine the possible significance of the rim to the cultural traditions of various tribes in Wyoming. If study results show that mitigations are necessary, appropriate mitigations would be developed by the BLM in consultation with the parties mentioned above, and included in the FEIS for the project.

Historic trails would be evaluated by a qualified historian, and contributing sections of historic trails would be avoided within 0.25 mi (0.40 km) unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area. The historic sites found near Carbon during the Class III survey of Alternate 3 would be spanned such that no structures are placed within the site. Mitigation of the site would include further data recovery of historic features. Because the site is eligible only under Criterion (D), no mitigation for visual effects would be needed.

Resources identified during Class III inventories of portions of the Foote Creek Rim area and Alternate 3 are presently being evaluated for NRHP eligibility in consultation with the BLM and SHPO. Features found during future Class III surveys would also be evaluated for eligibility. If any NRHP (eligible or listed) site cannot be avoided, a data recovery plan would be implemented as directed by the BLM.

In addition to the Class I and III inventories, construction activities in areas where the BLM believes there is a high potential for buried cultural deposits would be monitored by a BLM-permitted archaeologist. If historic or prehistoric materials are discovered during construction, further surface-disturbing activities at the site would cease, and appropriate BLM personnel would be notified by KENETECH, PacifiCorp, other Windplant owners, or their subcontractors to assure proper handling of the discovery by qualified archaeologists. An evaluation would be made by the AO to determine appropriate actions to prevent the loss of significant cultural resources.

Field personnel would be instructed not to disturb cultural resource sites or collect artifacts. KENETECH, PacifiCorp, and other Windplant owners would be responsible for the cost of the evaluation, and any decision as to proper mitigation measures (e.g., data recovery) would be made by the AO in consultation with the operator/owners. In the absence of a programmatic agreement, any discovered historic properties would be subject to mitigation through data recovery.

5.1.3.14 Socioeconomics

The primary measure for mitigating adverse impacts to communities affected by the proposed project would be the distribution of Impact Assistance Funds to Carbon and Albany Counties as required by WDEQ, Industrial Siting Council. Funds would be distributed to counties to offset impacts to infrastructure, housing, schools, etc. attributable to Windplant construction and operation (Section 4.4). Another primary mitigation would include commitments from KENETECH, PacifiCorp, or other Windplant owners to use local labor, where feasible. Windplant owners/operator would schedule concentrations of project traffic (e.g., truck convoys or heavy traffic flows) to avoid periods of expected increased traffic in the KPPA (i.e., the opening days of hunting seasons). Travel and parking would be restricted to access roads and on-site parking areas.

5.1.3.15 Land Use

Reclamation of nonessential areas disturbed during construction would be accomplished in the first appropriate season after construction. Nonessential areas include a 70.0-ft (21.3-m) wide corridor along turbine strings, 12.0 ft (3.7 m) on each side of all new roads, and all of the transmission and distribution line ROWs. KENETECH, PacifiCorp, or other Windplant owners would repair or replace fences and cattle guards and gates to maintain current BLM standards. Cattle guards would be used instead of gates for livestock control on most road ROWs. Livestock would be protected from underground cable trenches, and livestock access to existing water sources would be maintained.

Underground support structures (e.g., foundations) located greater than 6.0 ft (1.8 m) beneath the ground surface would be left in place, but all other facilities would be removed (after the LOP) to at least 6 inches (15 cm) below ground surface. Certain facilities (e.g., the 230-kV transmission line, authorized roads) may be left in place to be used for other beneficial purposes after the LOP.

Mitigations to prior rights include:

- locating facilities away from known underground cables and pipelines, where feasible;
- regrading and repairing roads as necessary in areas damaged by project-related activities;
- advance identification and flagging of all existing ROWs that would be crossed by proposed turbine strings, power lines, and roads;
- backhoe and hand excavation at pipeline crossings until the exact locations of underground lines have been determined; and
- restoration of native vegetation as soon as practical.

5.1.3.16 Visual Resources

Site-specific mitigations for impacts to visual resources would be identified during POD development. Aboveground facilities not requiring safety coloration would be painted with appropriate nonreflective environmental colors (e.g., Carlsbad Canyon or Desert Brown). Turbine blades would be nonreflective white or some other color scheme determined to improve rotor visibility to birds. Turbines and other facilities (e.g., roads, substations, power lines) would be located in seldom-seen areas, where feasible; facilities placement in foreground-middleground areas would be minimized, where feasible.

Cut-and-fill disturbance would be minimized. Long linear disturbances (e.g., roads) would be avoided or situated to minimize visual impacts where feasible. Revegetation would be initiated as soon as possible after disturbance. Topographic screening, vegetation manipulation, project scheduling, and traffic control procedures would be employed as deemed appropriate by the BLM to further reduce visual impacts.

Visual impacts from the 230-kV transmission line would be mitigated by locating the line in seldom-seen areas, where feasible, and using non-specular (low reflectivity) conductors and wooden poles.

5.2 MONITORING

KENETECH, PacifiCorp, and other Windplant owners each would identify an individual to serve as Environmental Compliance Coordinator (ECC). The ECC would be responsible for assuring that mitigation measures are implemented and monitoring activities are conducted as necessary to assure impacts are minimized.

5.2.1 Transportation and Facilities Construction

KENETECH, PacifiCorp, and other Windplant owners would provide qualified representatives on-site during construction to validate construction commensurate with the approved design.

5.2.2 Snow

Impacts of Windplant facilities on snow redistribution would be monitored by KENETECH O&M personnel; the Windplant also would be inspected periodically by authorized BLM or other agency personnel to identify potential problem areas. Methods would be specified in the POD for each phase and would include periodic examination of snow accumulation due to Windplant facilities and a report to the BLM on snow accumulation patterns. Possible problem areas would be inspected by the AO and/or other authorized BLM personnel to identify impacts and determine appropriate mitigation measures for future phases.

5.2.3 Paleontologic Resources

In addition to the predisturbance survey conducted as deemed appropriate by the BLM, specific, unavoidable high-value sites would be monitored as necessary by a qualified paleontologist during construction. If significant paleontologic materials are found during construction, all activities at the site would cease, and the AO would be notified immediately to assure proper handling of the discovery by a qualified paleontologist.

5.2.4 Soils

KENETECH, PacifiCorp, and other area operators would conduct regularly scheduled monitoring of erosion control structures within the KPPA to ensure maintenance of the operating integrity of these structures. Monitoring procedures and schedules would be specified in the PODs. Appropriate remedial action would be taken by owners/operators to correct nonfunctioning structures.

5.2.5 Water Resources

Windplant owners and KENETECH would conduct a regularly scheduled visual monitoring reconnaissance of surface waters to detect changes in water quality resulting from sedimentation. If necessary, periodic water samples would be analyzed to ensure that runoff from project areas is in compliance with federal and state water quality standards. Appropriate remedial actions would be taken to correct any noncompliance conditions.

5.2.6 Noise

Noise created by the Windplant would be monitored at sensitive receptor locations within the KPPA at least once per year. A BLM-approved monitoring system would be installed at selected receptors (e.g., known active sage grouse leks) for a period of at least a week to obtain a range of

noise conditions. Windplant-generated noise would be evaluated by a qualified professional, impacts identified, and appropriate mitigations implemented, if necessary.

5.2.7 Vegetation

The ECCs would monitor activities adjacent to wetlands to ensure that no discharge or fill would disturb these areas. KENETECH, PacifiCorp, and other Windplant owners in cooperation with the BLM would be responsible for monitoring revegetation success using criteria specified in PODs. The reclamation monitoring program would include written documentation to be furnished to the BLM regarding the effectiveness and success of reclamation.

5.2.8 Wildlife and Fisheries

Big game populations would be monitored beginning with construction of Phase I in an effort to define the overall impact of the Windplant to big game species within the KPPA (Appendix B). ECCs would also monitor project activity in big game crucial ranges during critical periods to ensure that no unauthorized use occurs and that authorized activities in these areas are conducted in the most efficient manner possible to limit potential adverse impacts.

Raptor, passerine, waterfowl, and shorebird monitoring would continue during and after Windplant construction as outlined in Appendix B. All raptor nests within the raptor nest survey area (and any additional areas designated by the BLM, WGFD, and USFWS) would be monitored every year in spring to determine activity. If the nest is active, additional monitoring would be used to determine productivity.

Any big game, raptor, or game bird mortalities on the KPPA noted by KENETECH personnel or contractors would be reported to the BLM, USFWS, and/or WGFD as soon as practical.

5.2.9 Cultural and Historic Resources

In addition to Class I and III inventories, construction activities in areas where the BLM believes there is a high potential for buried cultural deposits would be monitored by a BLM-permitted archaeologist. If historic or prehistoric materials are discovered during construction, all activities at the site would cease, and appropriate BLM personnel would be notified to assure proper handling of the discovery by a qualified archaeologist.

5.2.10 Land Use

Road signs on the KPPA would be maintained and monitored as deemed appropriate by the BLM. KENETECH, PacifiCorp, and other Windplant owners would conduct all maintenance and monitoring operations to ensure that signs are in proper repair and placed in the appropriate locations. Construction monitoring by the BLM may be conducted where proposed facilities cross existing underground pipelines or cables.

5.2.11 Hazardous and Solid Waste

Hazardous materials used, transported, stored, and disposed of as a component of this project would be in accordance with all federal and state rules and regulations and the HMMP for this project. This plan will be available for review at the BLM GDRA and Rawlins District Offices in early 1995, and will be included as an appendix to the FEIS for this project.

Any hazardous material spills would be handled as specified in SPCCPs (to be included in the PODs for each phase). The ECCs would be responsible for reporting spills of hazardous materials and implementing applicable procedures, monitoring, and reporting requirements.

Refuse would be hauled to state-approved sanitary landfills or other disposal sites. KENETECH, PacifiCorp, and other Windplant owners would store refuse collected on-site in containers prior to transport.

6.0 CONSULTATION AND PREPARERS

Personnel contacted or consulted during preparation of this EIS are listed in Table 6.1. The list of preparers and participants is given in Table 6.2.

Table 6.1 Personnel Contacted or Consulted.

Agency or Organization	Individual	Position
Albany County School District No. 1	Mike Bowman	Assistant Superintendent
Bonneville Power Administration	George Darr	Civil Engineer, P.E.
	Kathy Fisher	Environmental Specialist
	Chris Kondrat	Contract Manager
	Linda McKinney	Public Utility Specialist
	Kathy Pierce	Lead Environmental Specialist
	Colleen Spiering	Environmental EMF Specialist
	Richard Stone	Environmental Specialist
	Ben Underwood	Attorney
Bureau of Land Management		
Great Divide Resource Area	Frank Blomquist	Rangeland Management Specialist
	Tim Bottomley	Planning & Environmental Coordinator
	Connie Breckenridge	Wildlife Biologist
	Gary DeMarcay	Archaeologist
	Susan Foley	Soil Scientist
	Cheryl Hicks	Rangeland Management Specialist
	Mark Newman	Geologist
	Tom Rinkes	Wildlife Biologist
Rawlins District Office	Mary Apple	Public Affairs
	Dennis Carpenter	Assistant District Manager
	Missy Cook	Environmental Coordinator
	Walt George	Environmental Coordinator
	Ray Hanson	Recreation Planner
	Dick Larsen	Hazardous Materials Specialist
	Bob Tigner	Planning & Environmental Specialist
Cheyenne State Office	Tom Lahti	Landscape Architect
	Tim Novak	Cultural Resource Specialist
	Al Pierson	State Supervisor
	Roger Wickstrom	Natural Resource Specialist

Table 6.1 (Continued)

Agency or Organization	Individual	Position
California Fish and Game Department	Frank Wernette	Wildlife Biologist
Carbon County, Wyoming		
Carbon County Coalition	Steve F. Adams	Director
Carbon County Economic Development	Gene McMillan	Director
Carbon County Planning Office	Nina Adams	Planning Director
Carbon County Road and Bridge Department	Don Newman	Department Head
Carbon County School District No. 1	Jon H. Fisher	Assistant Superintendent
	Gina Gelsleichter	Secretary
Carbon County School District No. 2	Janice Fiedor	Secretary
	Nancy Kreg	Secretary to Superintendent
CNF Constructors, Inc.	Shawn Briggs	Engineer
Individuals	William Glenn	Soil Scientist
	Goldie Pitcher	Area Resident
	Dale Yates	Retired Realtor
	Gus Winterfeld	Paleontologist
Job Service	Margaret Blodgett	Manager
Judd Howell and Associates	Judd Howell	Biologist
KENETECH Windpower, Inc.	Robert Baker	Senior Meteorologist
	Richard Curry	Manager, Avian Research and Policy Development
	Bill Holly	Turbine Director
	Bruce Morely	Manager, Business Development
	Dana Peck	Project Manager
	Marci Proutt	Manager, Project Development
	Steve Steinhour	Director, Lands and Permits
KOA Campground	Gary Gaulke	Manager
Land and Water Fund	Gregg Eisenberg	Energy Analyst
Laramie Board of Realtors	Lori Dockter	Executive Officer
Laramie Regional Airport	Sonya Walker	Weather Observer
McFadden Elementary School	Jim House	Teacher
Native American Tribes		
Eastern Shoshone	--	--
Lower Brulé Sioux	--	--

Table 6.1 (Continued)

Agency or Organization	Individual	Position
Minneconjous Sioux	--	--
Northern Arapaho	--	--
Northern Cheyenne	--	--
Oglala Lakota Nation	--	--
White River Ute	--	--
Native Ecosystems Council and Friends of the Bow	Leila Stanfield Donald Duerr	Member Member
Nature Conservancy/Wyoming Natural Diversity Database	Chris Garber Mary Neighbours	Research Zoologist Information Manager
PacifiCorp, Inc.	Ted Huss Dale Raugutt	Region Land Agent Electrical Engineer
Raptor Research and Technical Assistance Center, Boise State University	Mark Fuller	Raptor Biologist
Sacramento Municipal Utility District	Paul Olmstead	Senior Project Manager
Sintek Realty	Chris Fournier	Realtor
South Dakota State University	Kenneth Higgens	Biologist
Steve Schaffer's Outfitters	Steve Schaffer	Owner
University of Colorado	Tamara Holmes	Biologist
University of Wyoming		
Atmospheric Sciences Department	Derek Montague John Morwitz	Professor Professor
Botany Department	Ron Hartman	Curator, Rocky Mountain Herbarium
Geology Department	Jason Lillegraven	Paleontologist
Geology Museum	Brent Breithaupt	Museum Curator/Paleontologist
U.S. Fish and Wildlife Service	Steve Brockman Charles P. Davis Wally Jobman Bob Prieksat	Fish and Wildlife Biologist State Supervisor Wildlife Biologist Special Agent
Western Ecosystems Technology Co.	Wally Erickson Dale Strickland	Biometrician Vice President
Wise Agency	Henry Hewitt	Broker
Wyoming Cooperative Research Unit	Loren Ayers Linda Kerley	Research Assistant Research Associate

Table 6.1 (Continued)

Agency or Organization	Individual	Position
Wyoming Department of Commerce	Fred Chapman	State Historic Preservation Office
	John T. Keck	State Historic Preservation Office
	Judy Wolf	State Historic Preservation Office
Wyoming Department of Employment	Mike Paris	Statistician
	Carol Kennedy	Employment Program Consultant
Wyoming Department of Environmental Quality	Gary Beach	Division Administrator
	Charles Collins	Administrator
	Vanessa Forselius	Senior Economist
	Dennis Hemmer	Director
	Bob Schick	Air Quality Analyst
	John Wagner	Technical Supervisor
Wyoming Department of Revenue, Excise Tax Division	Don Bright	Policy Analyst
Wyoming Department of Transportation	Spence Garrett	State Planning Engineer
	John Lane	Systems Planning Engineer
	Adam Uhrich	Transportation Survey Supervisor
Wyoming Division of Economic and Community Development	Ann McGowan	Librarian
Wyoming Employment Security Administration	Gordon Wolford	Statistician
Wyoming Game and Fish Department	Andrea Cerovski	Nongame Bird Biologist
	Richard Guenzel	Wildlife Biologist
	Greg Hiatt	Wildlife Biologist
	Patrick Hnilicka	Wildlife Biologist
	Bob Luce	Nongame Mammal Biologist
	Don Miller	Area Fishery Supervisor
	Bob Oakleaf	Nongame Coordinator
	Francis Peters	Director
	Reg Rothwell	Staff Biologist
	Steve Tessman	Environmental Biologist
	Tim Thomas	Wildlife Biologist
	Joe White	Deputy Director
	Pat White	Environmental Biologist
Wyoming Geological Survey	James Case	Geologist
	Gary Glass	State Geologist
Wyoming State Board of Equalization	Tom Roberts	Executive Secretary

Table 6.2 List of Preparers and Participants.

Name	Education/Experience	EIS Responsibility
BLM INTERDISCIPLINARY TEAM		
Mary Apple	B.S. Social Science; 11 years professional experience	Public Affairs
Tim Bottomley	B.S. Forest Management; 15 years professional experience	Environmental Coordinator
Missy Cook	A.A.S.; 7 years professional experience	Clerical, Environmental Coordinator
Gary DeMarcay	M.S. Anthropology, B.S. Anthropology; 21 years professional experience	Cultural Resources
Bev Derringer	15 years professional experience	Public Involvement
Susan Foley	B.S. Range Management; 5 years professional experience	Soils and Watershed
Walt George	M.S. Ecology, B.S. Wildlife Management; 18 years professional experience	Team Leader
Ray Hanson	B.S. Environmental Resources; 20 years professional experience	Recreation, Visual Resources
Cheryl Hicks	M.S. Range Science; 4 years professional experience	Land Use
Larry Jackson	B.S. Range Management; 20 years professional experience	Environmental Compliance
Dick Larsen	M.S. Soils, B.S. Forestry; 24 years professional experience	Hazardous Materials
Mark Newman	B.S. Geology; 16 years professional experience	Geology and Hydrology
Tom Rinkes	B.S. Wildlife Resources; 16 years professional experience	Wildlife
Marilyn Roth	15 years professional experience	Public Involvement
Bob Tigner	Ph.D. Environmental Biology, M.S. Wildlife Management, B.S. Game Management; 34 years professional experience	Assistant Team Leader

Table 6.2 (Continued)

Name	Education/Experience	EIS Responsibility
MARIAH ASSOCIATES, INC.		
Karyn C. Classi	M.S. Botany, M.S. Geology, B.A. Geology; 11 years professional experience	Project Management, Project Description, Physical Resources, Visual Resources
Genial G. DeCastro	B.S. Business Administration; 15 years professional experience	Technical Editing, Document Production
William Glenn	B.S. Agronomy, 28 years professional experience	Soils Scientist
Peter J. Guernsey	M.S. Range Management (pend.), B.S. Biology; 11 years professional experience	Quality Assurance
William M. Harding	M.A. Anthropology (pend.), B.A. Anthropology; 9 years professional experience	Cultural Resources
Carolyn W. Hayden	B.S. Animal Science; 12 years professional experience	Document Production/Coordination
Kelly M. Heinrich	6 years professional experience	Document Production/Coordination
Gary L. Heller	M.S. Zoology and Physiology, B.S. Wildlife Management; 7 years professional experience	Wildlife, Land Use, Socioeconomics, Hazardous Materials
Jonathan Hughes	M.S. Botany, B.S. Natural Resources, 4 years professional experience	Vegetation, Land Use
Heinz Jacobs	39 years professional experience	AutoCad
Patricia Kennedy	Ph.D. Zoology, M.S. Zoology, B.A. Biology; 16 years professional experience	Avian Wildlife
Craig L. Kling	M.S. Wildlife Biology, B.A. Ecology and Wildlife; 19 years professional experience	Quality Assurance, Project Management
Tamara Linse	3 years professional experience	Document Production/Coordination
Marion Maderak	M.S. Geological Engineering, B.S. Geology, 35 years professional experience	Physical Resources
Jason Marmor	M.A. Public History and Historic Preservation, B.A. Cultural Anthropology, 6 years professional experience	Historical Resources

Table 6.2 (Continued)

Name	Education/Experience	EIS Responsibility
Richard McGuire	M.S. Zoology, B.S. Wildlife and Fisheries Biology; 19 years experience	Quality Assurance
Ed Schneider	M.A. Anthropology, B.A. Anthropology; 10 years professional experience	Cultural Resources
Roger A. Schoumacher	B.S. Wildlife Management, M.S. Fisheries; 30 years professional experience	Quality Assurance
Craig S. Smith	M.A. Anthropology, B.A. Anthropology; 17 years professional experience	Cultural Resources
Diane Thomas	M.S. Zoology and Physiology, B.S. Wildlife Management, 5 years professional experience	Avian Wildlife
Joni Ward	M.S. Fishery and Wildlife Biology (pend.), B.S. Fishery and Wildlife Biology; 7 years professional experience	Avian Wildlife
BROWN-BUNTIN ASSOCIATES, INC.		
Paul Bollard	B.S. Mechanical Engineering; 7 years professional experience	Noise
TABLER AND ASSOCIATES		
Ron Tabler	M.S. Watershed Management, B.S. Watershed Management; 35 years professional experience	Snow

7.0 REFERENCES, ABBREVIATIONS, AND ACRONYMS

7.1 REFERENCES

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7.2 ABBREVIATIONS AND ACRONYMS

3C	Category 3 Candidate
ac	Acre(s)
AC	Alternating current
ACHP	Advisory Council on Historic Preservation
AFDC	Aid to Families with Dependent Children
Alternate	Alternate transmission line route
ANSI	American National Standards Institution
AO	Authorized officer
ASTM	American Society for Testing and Materials
AUM	Animal unit month
AWEA	American Wind Energy Association
BA	Biological assessment
bbls	barrels
BEPA	Bald Eagle Protection Act
BFF	Black-footed ferret
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
C1	Category 1 Candidate
C2	Category 2 Candidate
$CaCO_3$	Calcium carbonate
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
cf	Cubic feet
cfs	Cubic feet per second
CO	Carbon monoxide
CO_2	Carbon dioxide
COE	U.S. Army Corps of Engineers
Council	Northwest Power Planning Council
dBA	A-weighted decibel(s)
DEIS	Draft EIS
ECC	Environmental Compliance Coordinator
EIS	Environmental Impact Statement
EMF	Electric and magnetic fields
ENM	Environmental Noise Model
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EWEB	Eugene Water and Electric Board
FCR	Foote Creek Rim
FCRA	Foote Creek Rim area
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FICON	Federal Interagency Committee on Noise
ft	Feet
gal	Gallon(s)

GDRA	Great Divide Resource Area
gpm	Gallons per minute
HMMP	Hazardous Materials Management Plan
HMP	Habitat Management Plan
hr	Hour(s)
I-80	Interstate Highway 80
IDT	Interdisciplinary Team
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
IRP	Integrated Resource Plan
KENETECH	KENETECH Windpower, Inc.
km	Kilometer(s)
KOP	Key observation point
KPPA	KENETECH/PacifiCorp Project Area
kV	Kilovolt(s)
kW	Kilowatt(s)
kWh	Kilowatt hour(s)
LOP	Life-of-project
l	Liter(s)
lbs/ac	Pounds per acre
m	Meter(s)
m/s	Meter(s) per second
min	Minute(s)
Mariah	Mariah Associates, Inc.
MBTA	Migratory Bird Treaty Act
mcf	Thousand cubic feet
μg	Micrograms
mg	Milligrams
mG	Milligauss
mi	Mile(s)
mmcf	Million thousand cubic feet
mph	Miles per hour
MW	Megawatt(s)
N_2O	Nitrous oxide
NEMA	National Electrical Manufacturer's Association
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NETA	National Electrical Testing Association
NMHC	Non-methane hydrocarbon
Northwest Power Act	Pacific Northwest Electric Power Plan and Conservation Act
NO_x	Nitrogen oxide
NRHP	National Register of Historic Places
NTP	Notice to Proceed
NWI	National Wetlands Inventory
O&M	Operations and maintenance
ORV	Off-road vehicle
OSHA	Occupational Safety and Health Act
PacifiCorp	PacifiCorp, Inc.

PCB	Polychlorinated biphenyls
pCi/l	Picocuries per liter
PM10	Particulates ≤ 10 microns
PMZ	Primary Management Zone
POD	Plan of Development
PPM	Parts per million
PSCo	Public Service Company of Colorado
PSD	Prevention of significant deterioration
RCA	Raptor concentration area
RFP	Request for proposals
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-way
RSEP	Resource Supply Expansion Program
RV	Recreational vehicle
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SD	Standard deviation
SHPO	Wyoming State Historic Preservation Office
SI	Shut in
SMUD	Sacramento Municipal Utility District
SO_2	Sulphur dioxide
SPCCP	Spill Prevention Control and Countermeasure Plan
SPPP	Stormwater Pollution Prevention Plan
SRA	Simpson Ridge area
T&E	Threatened and endangered
TCP	Traditional Cultural Property
TDS	Total dissolved solids
TEC&S	Threatened, endangered, candidate or state sensitive
Tri-State	Tri-State Generation and Transmission Company
TSP	Total suspended particulates
TV	Television
UBC	Unified Building Code
UP	Union Pacific
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	Visual resource management
WDEQ	Wyoming Department of Environmental Quality
WDEQ-AQD	Wyoming Department of Environmental Quality-Air Quality Division
WDEQ-WQD	Wyoming Department of Environmental Quality-Water Quality Division
WEST	Western EcoSystems Technology, Inc.
WESTERN	Western Area Power Administration
WGFD	Wyoming Game and Fish Department
WGS	Wyoming Geological Survey

Wick Unit	Wick Brothers Wildlife Habitat Management Unit
Windplant™	Windpower plant
WNDD	Wyoming Natural Diversity Database
WOGCC	Wyoming Oil and Gas Conservation Commission
WRA	Wind resource area
WTG	Wind turbine generators

APPENDIX A:

AVIAN STUDIES PROTOCOLS FOR THE KENETECH WINDPOWER, INC. WINDPLANT PROJECT

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1.0 INTRODUCTION

KENETECH Windpower, Inc. is proposing to construct a 500 megawatt (MW) Windplant™ in the area between Arlington and Hanna in Carbon County, Wyoming. The Windplant will consist of approximately 1,400 wind turbine generators and related facilities, including transmission lines, communications systems, transformers, substations, roads, and operations and maintenance facilities. An environmental impact statement (EIS) is being prepared under a third party arrangement by Mariah Associates, Inc. for the Bureau of Land Management and the Bonneville Power Administration to assess potential impacts to the human environment due to Windplant construction. One of the primary issues is impacts to avian wildlife, especially avian mortality caused by collisions with turbines, power lines, or other structures. Because this would be the first commercial-scale Windplant in Wyoming, in-depth baseline avian use studies and comprehensive monitoring studies will be needed to adequately assess impacts of Windplant development on avifauna. The purpose of this report is to document the protocols currently being used for baseline data collection.

The proposed project would be constructed in phases beginning with erection of 202 wind turbines on Foote Creek Rim north of Arlington. Subsequent phases would be built in 50-75 MW increments over the next 10-12 years on Foote Creek Rim and in the Simpson Ridge area south of Hanna. The phased development provides an opportunity to monitor impacts of initial phases, gather additional baseline data, and develop appropriate mitigations for later phases.

Baseline avifauna data collected during 1994 are included in the EIS for the proposed project. The baseline studies include:

- point-count surveys for passerines, waterfowl, and shore birds, and mapping of raptors, waterfowl, mountain plover, and other shore birds observed on Foote Creek Rim;
- passerine point count surveys and mapping of raptors, waterfowl, and shore birds observed on the Simpson Ridge area;

- raptor use surveys on Foote Creek Rim and the Shirley Mountain reference area;
- raptor nesting surveys in and adjacent to the Foote Creek Rim and Simpson Ridge areas; and
- an inventory of sage grouse leks within and adjacent to the Foote Creek Rim and Simpson Ridge areas.

The schedule for baseline studies is shown in Table 1.1.

The following set of protocols describes the objectives, methods, and data analysis procedures for each of these studies, which will be developed prior to construction of the first phase. Baseline and monitoring studies will be expanded to other portions of the project area and adjacent areas prior to development of subsequent phases.

Table 1.1 1993-95 Baseline Studies Schedule.

Period	Survey/Study	Location/Area
October 1993	Species composition surveys	Foote Creek Rim and Simpson Ridge
Mid-February 1994 - March 1995	Point-count surveys	Foote Creek Rim
	Raptor, mountain plover, waterfowl, and shore bird mapping	Foote Creek Rim, Simpson Ridge
	Passerine point count surveys	Simpson Ridge
	Reconnaissance	Eastern slope, Foote Creek Rim
April 1994	Sage grouse lek survey	Foote Creek Rim and Simpson Ridge, plus a 2 mi buffer.
May - Mid-August 1994	Raptor nesting survey	Foote Creek Rim plus a 10 mi buffer, Simpson Ridge plus a 2 mi buffer.
June 1994 - March 1995	Raptor use surveys	Foote Creek Rim and Shirley Mountain Reference Area

2.0 PASSERINE AND RAPTOR SURVEYS - FOOTE CREEK RIM

2.1 PASSERINE SURVEYS

From mid-February to May 1994, point-count surveys for passerines and other non-raptors (i.e., waterfowl and shore birds) were conducted at 110-165 points on the eastern and western edges of Foote Creek Rim (Mariah Associates, Inc. 1994). Analysis of these data suggested that a reduced effort would provide adequate baseline data for passerine use and distribution on the rim, and therefore, the number of points was reduced to 32 on each side (see Section 2.1.2). Furthermore, it was determined that passerine density estimates could be improved if each point was enlarged from a 164 ft (50 m) radius to a 328 ft (100 m) radius. The revised passerine surveys were initiated in mid-May.

2.1.1 Objectives

The objectives of the Foote Creek Rim passerine and non-raptor surveys are to:

- determine species composition, relative abundance, density, and passerine, waterfowl, and shore bird use along the rim, and
- determine species composition in the shrub/woodland habitats adjacent to the rim.

The data collected to meet these objectives will identify passerine and other non-raptor use of development areas prior to facility construction and heavily used areas that should be avoided, and will serve as a basis for impact assessment, and as a baseline for monitoring changes in passerine activity after Windplant construction.

The study area for passerines and other non-raptors includes the rim top as well as a buffer of approximately 0.25 mi (0.4 km) surrounding the rim where there is a mosaic of distinct habitat types. On the eastern side of the rim, this area is characterized by aspen stands,

shrublands, and grassy habitats in the upper and central portions of the slope. On the western side, there are patches of shrubs mixed with grassland.

2.1.2 Methods

Passerine, waterfowl, and shore bird surveys on Foote Creek Rim have been (and will continue to be) conducted using a point-count method (Hilden et al. 1991; Ralph et al. 1993). Observations are made at 984 ft (300 m) intervals (points) along the western edge of Foote Creek Rim and at 656 ft (200 m) intervals along the eastern edge; all birds seen or heard within 328 ft (100 m) of each point are recorded. There are 32 points along each edge of the rim. Data collected include species, number of individuals, distance and direction from the point, time of day, activity, flight direction, and flight height class. Flight height classes are 0-26 ft (0-8 m), 26-184 ft (8-56 m), and >184 ft (56 m), which corresponds roughly with the area below, within, and above turbine blades, respectively.

Initially, survey starting points were systematically rotated through all survey points so that each point was sampled at various times of the day. Following the reduction of total sample points in mid-May, a simpler rotation was implemented, whereby one side of the rim is surveyed from south to north while the other side is surveyed beginning at the midpoint and working north in a loop until all 32 points are completed. The pattern is alternated between east and west sides weekly. In addition to simplifying the rotation sequence, this method minimizes disturbance, interference, and duplicate sampling between concurrent east and west side surveys. At each point, observations are made for a 5-minute period. Surveys are conducted beginning within 0.5 hour of sunrise and continued until all 64 points are surveyed (generally 5-6 hours after the start of the survey). Time-of-day effects will be accounted for using the methods specified in Palmeirin and Rubaca (1994).

A general observation reconnaissance has been conducted each month since February 1994 in the aspen/brush habitats on the eastern slope. Monthly reconnaissance of this area will

continue to be conducted to develop a species list of passerines, waterfowl, and shore birds in the study area.

2.1.3 Data Analysis

Species composition, relative abundance, and relative use will be computed for both passerines and non-raptors observed on Foote Creek Rim will be computed. Species diversity will be calculated using a Shannon-Weiner index. Relative densities (or use) by species will be calculated using program DISTANCE (Laake et al. 1993), described in Buckland et al. (1993). Program DISTANCE provides robust estimators that allow: variable sighting probability, clustered populations, and truncation of data. Seasonal differences in use of Foote Creek Rim by passerines, waterfowl, and shore birds will be evaluated graphically. If sample sizes are large enough (see Addendum A, Power Calculations), species will be grouped as passerine, waterfowl, or shore birds and the null hypothesis of "no difference in use on Foote Creek Rim between seasons (nesting, migration, winter)" will be tested at a significance level of α = 0.10. Depending on the distribution of the data, parametric or nonparametric tests will be used to test null hypotheses.

2.2 RAPTOR, MOUNTAIN PLOVER, WATERFOWL, AND SHORE BIRD MAPPING

During the point-count surveys, all raptors, waterfowl, mountain plovers, and other shore birds observed at any distance are mapped. These data will be analyzed using species use contours to determine species distribution along the rim. Contours will be generated using the graphics package SURFER (Golden Software 1990).

2.3 RAPTOR USE - FOOTE CREEK RIM AND REFERENCE AREA

Information on raptor use and distribution within the project area will assist in evaluating the potential impact of the Windplant on raptors. Pre- and post-construction monitoring in

development areas will give information on the effects of Windplant development on raptor use and distribution, but the cause of changes in use and distribution after development cannot easily be determined. Natural changes in populations may mask or inflate effects due to the project. Baseline data collection and monitoring use and distribution in a reference area will aid in isolating the effect of the project from natural variability. Therefore, a reference area has been established northwest of Hanna and west of the Shirley Mountains, Wyoming. This reference area is located within the wind corridor and to the northwest of the project area and has topographic features similar to the Simpson Ridge area, including prominent ridges (e.g., Horseshoe and Schneider Ridges) with adjacent rolling plains and a nearby riparian corridors (the North Platte River). Historical nesting data has been evaluated for the reference area, and the raptor species composition within 10 mi (16.1 km) of the reference area appears to be similar to the species composition of nests within and adjacent to Foote Creek Rim and Simpson Ridge. Finally, the reference area is more than 20 mi (32.2 km) away from the Simpson Ridge area so that it can be used for monitoring throughout the life-of-project. See Section 2.4.2 for a rationale for using 10 mi (16.1 km) buffer areas around the proposed development and reference areas.

2.3.1 Objectives

The primary goals of the baseline raptor use studies are to determine and compare the relative use of Foote Creek Rim and the Simpson Ridge area and a similar reference area. The objectives of raptor observation surveys will be to:

- determine relative use, species composition, and species diversity of raptors on Foote Creek Rim and within the reference area,
- determine seasonal variation in raptor use of selected viewpoints, and
- enable the future evaluation of Windplant effects on raptor use, species composition, and species diversity.

2.3.2 Methods

Raptor observations are made using a skyline watch technique (Mariah Associates, Inc. 1979). During all seasons, adult raptors are active for portions of each day, and thus, will be seen during the skyline watch. Vigils 3 hours in length are conducted in strategic locations on ridge tops, thus permitting the observers an unrestricted panorama over a wide area.

Viewpoints have been systematically selected to provide maximum coverage of Foote Creek Rim and a selected portion of the reference area without overlapping views. Six viewpoints have been established on Foote Creek Rim (Figure 2.1) and six within the reference area. A 360°, 0.5 mi (0.8 km) radius viewshed is monitored from each viewpoint. Each viewshed has been surveyed for prominent topographic features which will be used in conjunction with manmade landmarks for estimating distance of raptors from the viewpoint. The locations of the viewpoints and the landmarks will be mapped using a Global Positioning System (GPS). Observers have been trained to recognize landmarks and topography to accurately map the locations of observed raptors at first detection during the skyline watch. With accurately mapped locations, distance from the viewpoint of each observation can be accurately determined.

The raptor surveys are limited to the 0.5 mi (0.8 km) radius viewshed. All raptors observed are positively identified to species, if possible, with the aid of binoculars and a spotting scope, and their locations are recorded.

In addition to continuous monitoring of the 0.5 mi (0.8 km) radius viewshed, 12 (total) instantaneous counts are made at 15-minute intervals beginning 12 minutes after the start of each observation period. The 0.5 mi (0.8 km) radius viewshed is searched for a 2-3 minutes, and all raptors within the area are recorded. Instantaneous counts provide a more thorough evaluation of raptor use of the area by enabling repeated observations of

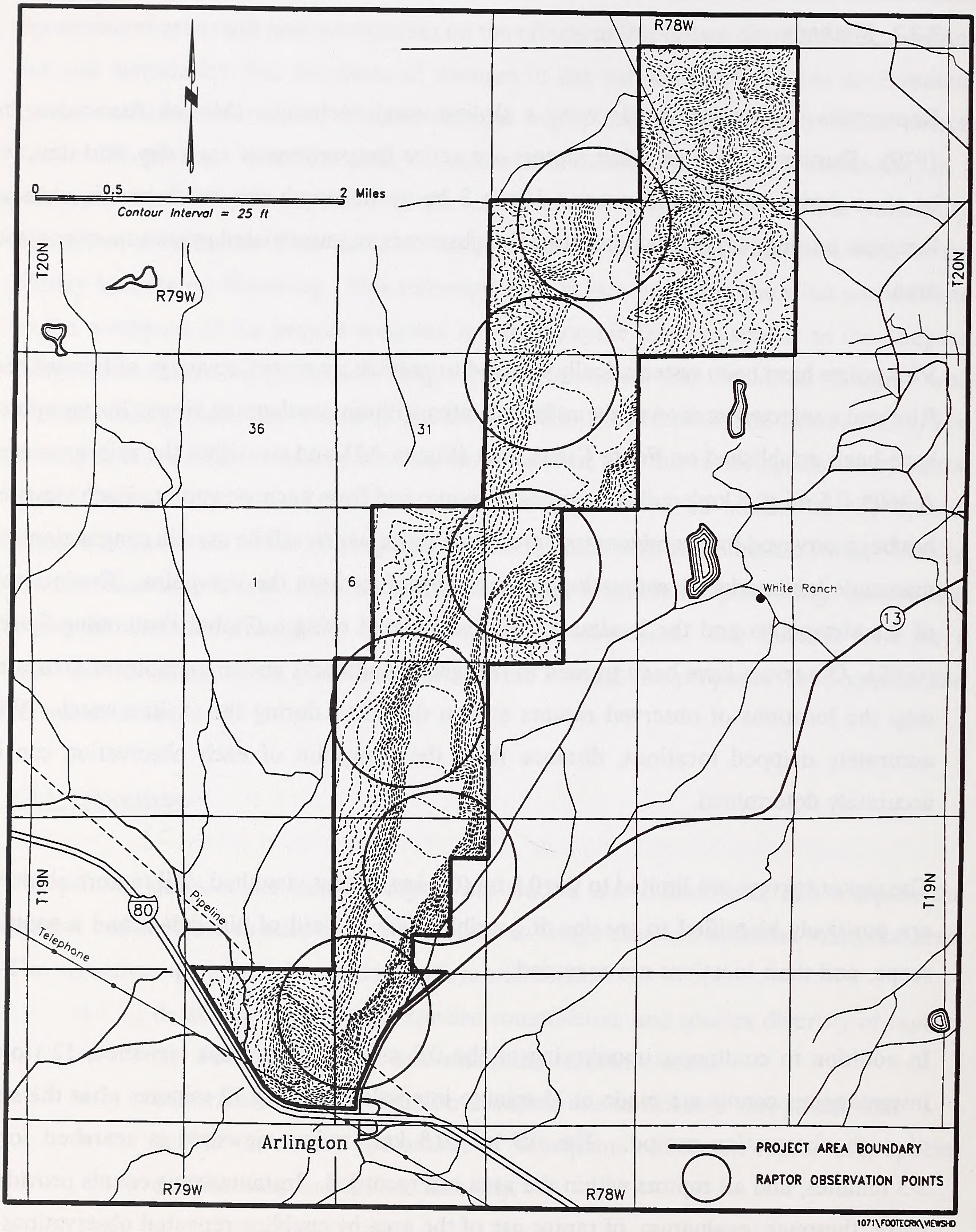

Figure 2.1 Locations of 0.5 Mile Raptor Viewsheds on Foote Creek Rim.

individuals that stay in the area during the watch period. Flyovers are recorded during the continuous monitoring.

Observations include species, number of individuals or frequency of sightings, activity, time of day, and flight direction. An estimate of the flight height class (or range of classes) is made for each individual. Flight height classes of 0-26 ft (0-8 m), 26-184 ft (8-56 m), and >184 ft (56 m) are used.

Sampling frequency is as follows:

- weekly during the raptor nesting and mitigation seasons--mid-February through October, and
- biweekly during winter--November through mid-February.

Each area is sampled in one day using three observers, each completing two 3-hour vigils. Foote Creek Rim and the Shirley Mountain reference area are sampled on consecutive days whenever possible. Sampling occurs during morning and early afternoon hours, between 8:30 am and 4:30 pm when raptors are typically most active.

Incidental data pertaining to physiographic features (e.g., the presence of canyons near ridge tops) or biological features (e.g., number of nests within or immediately adjacent to the viewpoint) will be included in the qualitative discussion of raptor use in the study and reference areas. These data will be used during monitoring to determine if certain physical or biological features affect the level of impact to raptors.

Due to topographic variability within each viewshed, a visibility bias may be inherent in the survey methods, especially if part of the 0.5 mi (0.8 km) radius viewshed is blocked by topographic features. The visibility bias will be minimized by locating viewpoints to include as much of the 0.5 mi (0.8 km) viewshed as possible. In cases where a 0.5 mi (0.8 km) viewshed cannot be obtained, observational data will be normalized to a 0.5 mi (0.8 km)

radius survey area. The actual viewshed area for each point will be estimated, and a correction factor will be applied to the data.

Measures taken to minimize the number of duplicate observations include the following:

- viewsheds do not overlap, and
- the three observers are in radio contact with one another and report all sightings.

Observers are rotated among points so that each observer spends approximately the same number of survey days at each of the 12 points.

2.3.3 Data Analysis

Species composition will be summarized, and a map of species distributions prepared. Relative abundance of each species will be computed as numbers of individual sightings per unit of observation area and/or time. Species diversity will be computed using a Shannon-Weiner index. Raptor use contours will be generated using the graphics package SURFER (Golden Software, Inc. 1990), where appropriate, to identify patterns or trends in use or distribution.

If sample sizes are large enough (see Addendum A, Power Calculations), the null hypothesis of "no difference in relative abundance of raptors on Foote Creek Rim versus the reference area" will be tested during pre-construction by season (nesting, migration, winter). Repeat observations will be pooled and stratified by season. Depending on the distribution of the data, parametric or nonparametric tests will be used to test the null hypothesis at significance level of $\alpha = 0.10$. Collection of data will allow testing of null hypotheses during post-construction as well.

Effects of topographic or other landscape features on raptor use and abundance will be assessed qualitatively or graphically, depending on the characteristics of the data set. For example, it may be observed that golden eagle relative abundance is higher in

topographically dissected areas than in areas with smooth slopes; this could then be illustrated on a graph showing degree of dissection vs. golden eagle abundance. These types of analyses will assist in planning future phases of the project to locate turbines away from potential high use areas. The null hypothesis of "no difference in turbine contribution to raptor mortality based on turbine placement" will be tested. Tests of association between topographic features and raptor mortality will also be conducted.

2.4 RAPTOR NESTING SURVEYS

Raptor nests are protected from taking and disturbance by the Migratory Bird Treaty Act (16 U.S.C. 703-711), and the BLM typically imposes seasonal use restrictions on buffer areas around active raptor nests. Information on the location of raptor nests in and adjacent to the project area will assist in locating turbines and facilities such that nests will not be destroyed at any time and birds will not be disturbed during the nesting season. Monitoring nests in the construction areas, both pre- and post-construction, will give information on the status of nests before and after construction. These data will provide a baseline for nesting pairs occupying territories within the area of potential influence of the project. This information, in conjunction with the use data, is used in the EIS to describe the existing environment and to evaluate potential impacts for each alternative.

2.4.1 Objectives

The objectives of the raptor nesting surveys are to:

- identify all raptor nests on and within 10 mi (16.1 km) of the ends of proposed turbine strings on Foote Creek Rim,
- determine nest status, and
- determine reproductive success.

The data will be used to locate project activities to avoid nests during the nesting season and will provide initial nesting productivity information for use in subsequent monitoring.

2.4.2 Methods

A combination of aerial and ground surveys was conducted from May through mid-August 1994 to obtain the raptor nesting information. An aerial survey of the entire project area (Foote Creek Rim plus a 10 mi [16.1 km] buffer and the Simpson Ridge area plus a 2 mi [3.2 km] buffer) was completed in May and June 1994 by helicopter. Literature indicates that 10 mi (16.1 km) is the mean maximum distance from the nest for many nesting raptor species, although individual golden eagles and prairie falcons have been reported as far as 17-22 mi (27.4-35.4 km) from the nest (Call 1978; data from Snake River Birds of Prey Study; personal communication, with Dale Strickland, WEST, Inc., Cheyenne, 1994). The 10 mi (16.1 km) buffer represents an area of potential influence on nesting populations within which most of the raptor activity would take place that may be influenced by the Windplant on Foote Creek Rim. Because the Simpson Ridge area would not be developed for several years, the initial nest inventory at Simpson Ridge included a 2 mi (3.2 km) buffer which is commonly used for permitting development projects in Wyoming. Assuming the golden eagles and prairie falcons of the Snake River studies represent the population in the Foote Creek Rim study area, the use of a 10 mi (16.1 km) buffer should be expected to study a minimum of 70% of the golden eagles and prairie falcons that would be affected by the project (personal communication, with Dale Strickland, WEST, Inc., Cheyenne, 1994). The eagles and falcons within the 10 mi (16.1 km) buffer should also be at greater risk than others that are beyond the 10 mi (16.1 km) because they should spend a significantly greater amount of time in the study area.

During the aerial survey, the pilot and one observer conducted a search for nests in suitable raptor nesting habitat. The location of each nest observed was documented with a GPS. Data on location, nest activity, and number of chicks were also recorded. Ground surveys were completed from June to mid-August to determine the status of nests that could not be viewed during helicopter surveys and to determine reproductive success. All active nests identified during the aerial survey were visited and the number of nestlings/fledglings recorded when possible.

2.4.3 Data Analysis

Number of nests by species, activity status, and productivity for 1994 has been summarized and described in the EIS. Nest locations have been mapped to assist in planning Windplant development. Due to the sensitive nature of this information, maps will not be included in the EIS but will be provided to appropriate agencies and to KENETECH, upon request.

3.0 PASSERINE AND RAPTOR SURVEYS - SIMPSON RIDGE

3.1 OBJECTIVE

The objective of the avifauna surveys on the Simpson Ridge area is to document the species present, relative abundance, and use of the area. These qualitative data gathered over several years will provide information on the existing environment in the Simpson Ridge area and, when supplemented with quantitative studies such as those being conducted on Foote Creek Rim, would serve as the basis for impact assessment for that area. More detailed quantitative surveys such as those conducted on the Foote Creek Rim area is not being conducted on the Simpson Ridge area at this time because the area will not be subject to development for approximately 2-4 years. Detailed surveys will be conducted in the turbine string areas 1-2 years prior to development.

3.2 METHODS

Surveys on the Simpson Ridge area use the Cooperative Breeding Bird Survey methods, which involve a point-count at 0.5 mi (0.8 km) intervals. At each point, all passerines heard or seen within 0.25 mi (0.4 km) of the point during a 3-minute period are recorded as to species, number of individuals, location, activity, flight height class, and direction of flight. Surveys begin within 0.25 hour of dawn and continue until all points are surveyed, generally 8 or 9 hours after sunrise. Surveys are conducted biweekly. Starting point and direction are varied such that early morning surveys (within 3 to 4 hours of sunrise) are completed along all portions of the route.

The survey route includes three segments: 1) 22 points along Wyoming Highway 72, 2) 9 points along Percy Creek on the western side of Simpson Ridge, and 3) 22 points along the Simpson Ridge/Carbon area in the eastern side of the project area. During winter and early spring, access to the Percy Creek and Simpson Ridge/Carbon areas is limited due to snow and mud, and the number of points surveyed is reduced accordingly.

3.3 DATA ANALYSIS

Qualitative assessments of species composition, relative abundance, and species diversity will be determined. These data are used in the EIS to describe the existing environment and evaluate potential impacts.

4.0 SAGE GROUSE LEK SURVEYS

4.1 OBJECTIVE

The objective of the sage grouse lek survey was to verify the location of sage grouse leks shown on Wyoming Game and Fish Department and Bureau of Land Management (BLM) maps and to locate additional leks not previously recorded. The lek is considered the center of the breeding/nesting complex, and most nesting activity occurs within approximately 2 mi (3.2 km) of the lek. Standard BLM stipulations prohibit construction activities and/or surface disturbance within 2 mi (3.2 km) of leks during the period from February 1 to July 1. The area of influence and study area for sage grouse, therefore, is the project area plus a 2 mi (3.2 km) buffer.

4.2 METHODS

Aerial surveys were used to locate sage grouse leks. Two separate aerial searches were conducted over the study area during April 1994. The surveys commenced at first suitable light and ceased approximately 3 hours after sunrise. A high-wing fixed-wing aircraft was flown along north-south transects spaced at 0.5 mi (0.8 km) intervals over the study areas. The plane was flown as low (100-300 ft [30.5-91.4 km] aboveground level) and slow (50-80 knots) as safety considerations allow. The pilot and one observer inspected the search area, which was approximately 0.25 mi (0.4 km) on either side of the transect, looking for sage grouse congregated on the lek. The location of leks observed was documented with a GPS on the aircraft and mapped on 7.5 minute topographic maps. The number of cocks, hens, and birds of unknown sex on the leks was recorded.

All historical leks were located, along with several leks not previously mapped. Therefore, no ground verification was necessary (personal communication, with Tom Rinkes, BLM, Rawlins, 1994).

4.3 DATA ANALYSIS

Locations of leks and the 0.25 mi (0.4 km) (potential breeding habitat) and 2.0 mi (3.2 km) (probable nesting habitat) zones will be displayed on a sage grouse breeding complex map. Proposed turbine string and transmission line locations will be overlaid on this map to determine location and amount of sage grouse habitat potentially impacted by development of the Foote Creek Rim phase of the project. Sage grouse information on the Simpson Ridge area will be used to identify sensitive resource areas to be included in EIS impact analysis and appropriate siting of future phases of development.

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ADDENDUM A:

POWER CALCULATIONS

Table 1 Power of a Test for Various Sample Sizes, N, to Compare Two Proportions, with the Size of the Test, α = 0.10 (Two-Tailed), Assuming the Reference Value is pl = 0.8.

N	0.5	0.4	0.3	0.2	0.1
5	0.083	0.137	0.212	0.317	0.469
7	0.139	0.234	0.364	0.533	0.737
9	0.198	0.333	0.506	0.704	0.889
11	0.258	0.428	0.629	0.823	0.958
13	0.317	0.516	0.727	0.899	0.985
15	0.374	0.595	0.804	0.945	0.995
17	0.429	0.664	0.862	0.971	0.999
19	0.481	0.723	0.904	0.985	1.000
21	0.529	0.774	0.934	0.992	1.000
23	0.575	0.816	0.955	0.996	1.000
25	0.617	0.852	0.970	0.998	1.000
27	0.656	0.881	0.980	0.999	1.000
29	0.692	0.905	0.987	1.000	1.000

Table 2 Power of a Test for Various Sample Sizes, N, to Compare Two Proportions, with the Size of the Test, α = 0.10 (Two-Tailed), Assuming the Reference Value is pl = 0.7.

N	0.5	0.4	0.3	0.2	0.1
5	0.046	0.082	0.135	0.212	0.327
7	0.073	0.135	0.228	0.364	0.551
9	0.099	0.189	0.324	0.506	0.725
11	0.126	0.245	0.416	0.629	0.842
13	0.152	0.299	0.501	0.727	0.914
15	0.179	0.353	0.578	0.804	0.955
17	0.206	0.404	0.647	0.862	0.977
19	0.232	0.453	0.706	0.904	0.989
21	0.258	0.500	0.757	0.934	0.994
23	0.283	0.543	0.801	0.955	0.997
25	0.308	0.584	0.837	0.970	0.999
27	0.333	0.622	0.868	0.980	0.999
29	0.357	0.658	0.893	0.987	1.000

APPENDIX B:

GENERAL DESIGN
WYOMING WINDPOWER MONITORING PROPOSAL

DRAFT
GENERAL DESIGN
WYOMING WINDPOWER MONITORING PROPOSAL

Submitted to

KENETECH Windpower, Inc.
San Francisco, California

Submitted by

Western EcoSystems Technology, Inc.
2003 Central Avenue
Cheyenne, Wyoming 82001

January 1995

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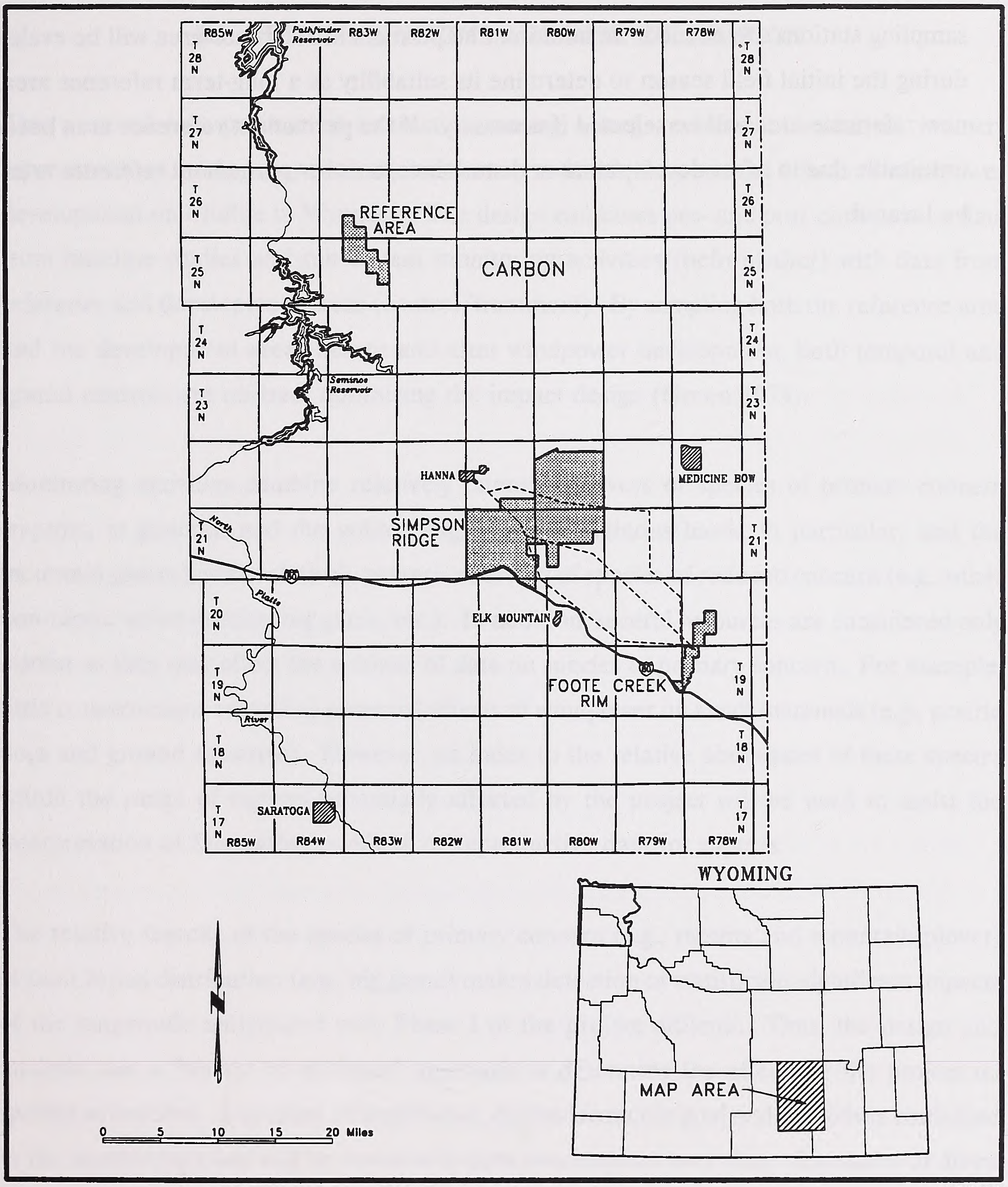
1.0 INTRODUCTION

The following describes the conceptual design and study methods of the monitoring study for the proposed 500-megawatt (MW) Windplant™ in the KENETECH Windpower, Inc. (KENETECH)/PacifiCorp, Inc. (PacifiCorp) Project Area (KPPA) between Arlington and Hanna in Carbon County, Wyoming. This Windplant will consist of approximately 1,390 wind turbine generators and related facilities, including transmission lines, communications systems, transformers, substations, roads, and operations and maintenance facilities. The studies are designed to collect baseline data prior to construction, as well as data to evaluate the potential effects of the Windplant during and after the construction period based on comparisons with reference areas.

For most surveys, three areas will initially be studied: Foote Creek Rim, Simpson Ridge, and a permanent reference area (Map 1.1). Foote Creek Rim provides the initial development area to be compared with a similar reference area. The Simpson Ridge area provides a second reference data set as well as pre-construction data for future expansion of the project. Future development in the Simpson Ridge area will be monitored at least three years prior to construction. However, if KENETECH decides not to proceed with further development at Foote Creek Rim, due to wildlife or other concerns, then KENETECH may apply for a BLM Notice to Proceed for the Simpson Ridge area. BLM will not approve any such application until one year of monitoring has been completed at Simpson Ridge. There will always be one permanent reference area (i.e., not proposed for development) to compare to the development areas. Any development area monitored prior to construction will serve as a second reference area for areas already under construction or with construction completed.

The permanent reference area and Foote Creek Rim are approximately the same size and the sampling intensity of raptor use studies covers both areas. Simpson Ridge is larger than the other two areas and the proposed sampling is less intensive. The sampling intensity for Simpson Ridge will be evaluated during the first field season to determine if additional



Map 1.1 Locations of the Foote Creek Rim and Simpson Ridge Project Areas and the Permanent Reference Area. The KPPA Includes the Foote Creek Rim and Simpson Ridge Project Areas Plus the Three Alternate Transmission Line Routes Shown on This Map.

sampling stations are needed. In addition, the permanent reference area will be evaluated during the initial field season to determine its suitability as a long-term reference area. A new reference area will be selected if necessary. If the permanent reference area becomes unsuitable due to other development or disturbance, another permanent reference area will be located.

2.0 DESIGN CONCEPTS AND RISK EVALUATION

This protocol is a product of interaction among a large number of scientists, industry representatives, and agency professionals concerned with the potential effects of windpower development on wildlife in Wyoming. The design combines pre- and post-construction data from baseline studies and subsequent monitoring activities (before/after) with data from reference and development areas (control/treatment). By sampling both the reference area and the development areas before and after windpower development, both temporal and spatial controls are utilized, optimizing the impact design (Green 1979).

Monitoring activities combine relatively intensive surveys of species of primary concern (raptors, in general, and the golden eagle and ferruginous hawk, in particular; and the mountain plover), with relatively extensive surveys of species of reduced concern (e.g., other non-raptor avian species, big game, etc.). In addition, several resources are considered only insofar as they may affect the analysis of data on species of primary concern. For example, little concern exists regarding potential effects of windpower on small mammals (e.g., prairie dogs and ground squirrels). However, an index to the relative abundance of these species within the range of raptors potentially affected by the project will be used to assist the interpretation of fluctuating numbers or reproductive data for raptors.

The relative scarcity of the species of primary concern (e.g., raptors and mountain plover) or their broad distribution (e.g., big game) makes detection of statistically significant impacts of the magnitude anticipated with Phase I of the project difficult. Thus, the design and analysis uses a "weight of evidence" approach to determine the effects of the project on species of concern. A number of hypotheses, derived from the goal and objectives contained in the monitoring plan, will be tested with data accumulated over time. Estimates of direct mortality can be made in a given year through carcass searches, but tests of other parameters (e.g., nesting success) for any given year may have relatively little power to detect an effect of windpower development on the resources of concern. However, the trend of effects should be discernable and indicate if they are of a magnitude warranting

additional, more detailed, study. The monitoring plan does not estimate population parameters but only indices of population parameters. This monitoring plan, as designed, is a dynamic process that uses an accumulation of data to detect impacts and to direct further study.

The weight of evidence approach is illustrated by the following discussion. Depending on the resource of concern, the evaluation of effects from the wind energy development includes effects on individuals, such as use effects (e.g., reduction in use of the area occupied by the turbines), and population effects, such as mortality (e.g., death due to collision with a turbine) and reproduction (e.g., effect on reproduction in the area). The evaluation of effects is important in determining effective and adequate mitigative measures. For each resource monitored, potential effects and methods of evaluating these effects from the wind energy development are discussed below. The actual effects, if any, will not be known until monitoring begins and data have been evaluated.

2.1 RAPTOR RESOURCE

Several outcomes are possible from the raptor studies. For example, a decline in raptor use on the Foote Creek Rim area without a similar decline on the reference area(s) may be interpreted as evidence of an effect of windpower development. The presence of carcasses near turbines and/or a decline in nesting activity increases the weight of evidence that an effect can be attributed to windpower. A decline in use of both the reference and development area (i.e., an area with wind turbines) coupled with few to no carcasses may be interpreted as a population response unrelated to windpower. Other factors, such as differential prey availability between the reference areas and development areas, will aid in separating out effects of wind turbines from effects due to other factors.

The level at which mortalities are considered significant is subjective and will depend on the species involved. A significant number of carcasses associated with turbine strings may suggest a population effect, particularly during the breeding season. A significant number

of carcasses associated with a decline in use relative to the reference area and/or a decline in number of active nests may be interpreted as a probable population effect.

The above monitoring efforts would yield indices of population effects. If evidence suggests negative impacts on raptors, additional, more detailed studies of raptor population dynamics will be necessary to determine the significance of impacts (e.g., the effect of mortalities on the dynamics of the populations).

2.2 NON-RAPTOR AVIAN RESOURCE

As with the raptor resource, a decline in non-raptor avian use on development areas without a similar decline on the reference area(s) may be interpreted as evidence of an effect of windpower development. A decline in avian use coupled with mortalities associated with the turbines corroborates this interpretation. A decline in avian abundance on both the reference area(s) and development area(s) may be attributed to population responses to unknown factors.

2.3 BIG GAME RESOURCE

Big game issues related to the proposed Wyoming wind energy project are similar to the issues facing big game whenever land use changes. The KPPA is occupied seasonally by populations of pronghorn, mule deer, white-tailed deer, and elk. All of these species use the KPPA as winter habitat as well as during other seasons of the year. Thus, project features such as turbines, roads, buildings, and fences will result in direct habitat loss. The importance of this loss depends on the quality and quantity of habitat lost and the degree of dependence on that habitat by the species of concern.

Projects resulting in direct habitat loss also frequently result in the loss of use of habitat due to displacement. Each project feature and the construction of the project will have some zone of influence which will extend for some distance. Effects of construction activities,

roads, and power lines are somewhat predictable, based on other similar projects. However, the wind turbines are a new form of disturbance, and animals' responses to them are uncertain. Potential disturbances include maintenance activities, the visual appearance of the turbines and turbine strings, and the noise resulting from their operation.

Disturbances to daily movements and feeding activities are of interest. However, the effect of turbine strings on seasonal migrations, particularly for pronghorn, are of the highest concern. Pronghorn may habituate to the turbine strings and move around or across them as they often do barbed wire fences and unfenced roads. However, they may view the strings as an obstruction and refuse to pass under them, as they apparently refuse to make use of highway underpasses.

The use of the KPPA by big game animals will be evaluated before, during, and after construction of the turbines. Resource selection models will be developed, relating the probability of use to habitat, topography, and other environmental conditions. These features, as well as the use at varying distances to the turbines before and after construction, will be evaluated as a potential predictor of use of the KPPA development areas. The density of pellet groups and habitat selection by groups of animals recorded during aerial surveys will be considered an indicator of animal use. If the wind turbines have little effect on use of habitat by big game, then we would expect the distance from turbines to be a poor predictor of use. We would also expect the average amount of use of areas associated with turbines before and after construction to be approximately equal. Interactions between the other environmental factors and distances to turbines before and after construction will be used to separate out effects of these factors from possible wind turbine effects. These models will be evaluated seasonally. Multi-year estimates of use are important to accurately evaluate use effects.

Aerial surveys will also be used to estimate pronghorn and elk abundance and gross distribution before and after construction of the project. Observations will be made of all

other big game using the area surveyed. However, the survey technique provides a poor estimate of distribution for mule and white-tailed deer.

The above measures of effect are indirect and can be used to determine mitigation measures necessary to reduce or eliminate the effects of windpower development on big game. If turbines significantly influence habitat use, additional population studies may be necessary to determine if these effects influence the viability of the population (i.e., reproduction and mortality).

2.4 SAGE GROUSE RESOURCE

The sage grouse resource will be evaluated through population trends, use, and mortality. A decline in the population or use in a development area may be interpreted as an effect of windpower development if other factors such as snow patterns, vegetation, and water cannot fully explain these declines. There is the potential for direct mortality associated with the turbines for birds moving long distances. Although the majority of sage grouse activity is conducted on the ground or at very low altitudes, birds moving long distances may fly within the zone of the turbine rotors.

3.0 GOAL

The goal of the monitoring studies is to provide an evaluation of the effect of Windplant development on common raptor species and other wildlife resources potentially at risk from wind energy development and to aid in identifying future turbine locations and possible design modifications that minimize impacts to wildlife.

4.0 COMPONENTS OF MONITORING STUDY

The monitoring program is designed to study wildlife thought to be at risk from wind energy development. The monitoring plan proposes intensive studies on raptors, the mountain plover, and big game, and extensive studies (i.e., less intensive) of non-raptor avian species, raptor prey species, and sage grouse.

4.1 RAPTOR RELATIVE DENSITY AND USE

4.1.1 Point Count Surveys for Raptors

4.1.1.1 Objective

The objective of the raptor use surveys is to estimate the spatial and temporal use of the Foote Creek Rim and Simpson Ridge areas, and a permanent reference area by the raptor species of interest.

4.1.1.2 Introduction

Raptor use is considered an index to density for species using the study areas. Use will be measured by making repeated instantaneous and continuous counts of birds observed within sample plots. It is assumed use will be influenced by biological and physical characteristics of the site and/or the home range of the raptor. Each bird detected during instantaneous counts will be located in relation to existing or measured information regarding the physical and biological characteristics of the site.

4.1.1.3 Field Methods

Locations of stations (observation circles) on Foote Creek Rim will be the same as used by Mariah Associates, Inc. (Mariah) in 1994 (Figure 4.1). Six stations, three on the western edge of the rim and three on the eastern edge of the rim, will be visited. Six stations will be located on the portion of the Simpson Ridge area scheduled for development in the near future. If this initial area is much greater in size than Foote Creek Rim, additional stations will be established. As other areas come on-line for development, additional stations will be established and sampled. Six stations will also be established on the permanent reference area in a similar fashion (Figure 4.2).

Each station will be a 0.5 mi (0.8 km) radius circle centered on an observation point. Landmarks will be located to identify the 0.5 mi (0.8 km) boundary of each station. The boundary will be flagged if there are no landmarks. Incidental observations of birds beyond the 0.5 mi (0.8 km) radius will be recorded, but will be analyzed separately from the data collected within the plot.

Observations will be made every other week during the winter period and weekly during the rest of the year (Table 4.1). For the purpose of this protocol, the winter period is defined as November 1 through February 13. Visual observations will be made so as to cover all daylight hours. Each station will be visited twice on each sampling day, once during the morning (0600-1200) and once during the afternoon (1200-1800).

Data collected during each station visit will consist of instantaneous counts, as well as counts during a 40-minute interval to establish use of stations by species. Instantaneous counts will be taken at the beginning of the 40-minute interval, and every five minutes thereafter. A schedule will be developed by the study team leader prior to field work, to ensure each station is surveyed about the same number of times during each period of the day each season. The observation period per station visit (i.e., 40 minutes) will be evaluated based on the data collected during baseline studies and during the first breeding season.

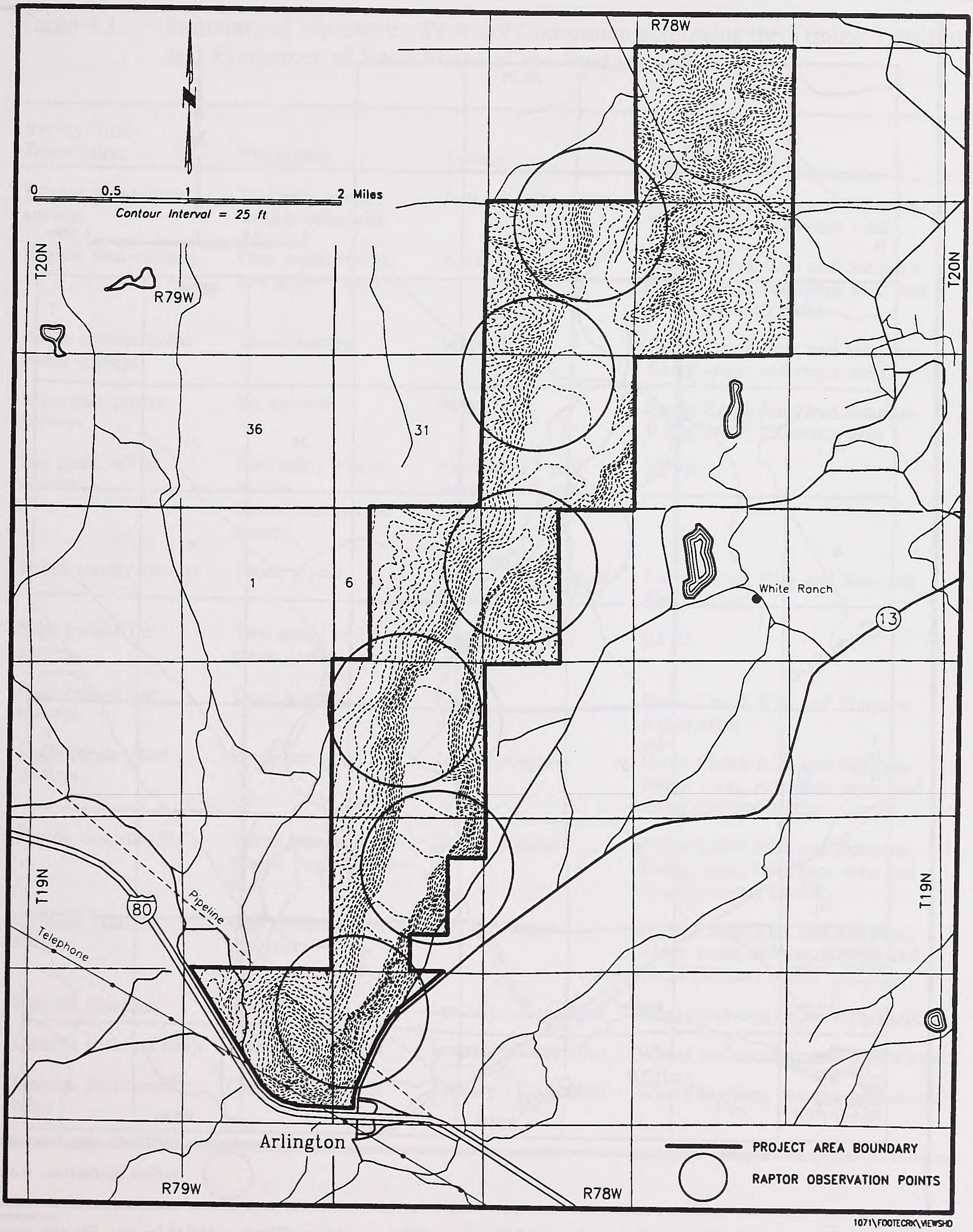


Figure 4.1 Approximate Locations of Raptor Observation Circles on Foote Creek Rim.

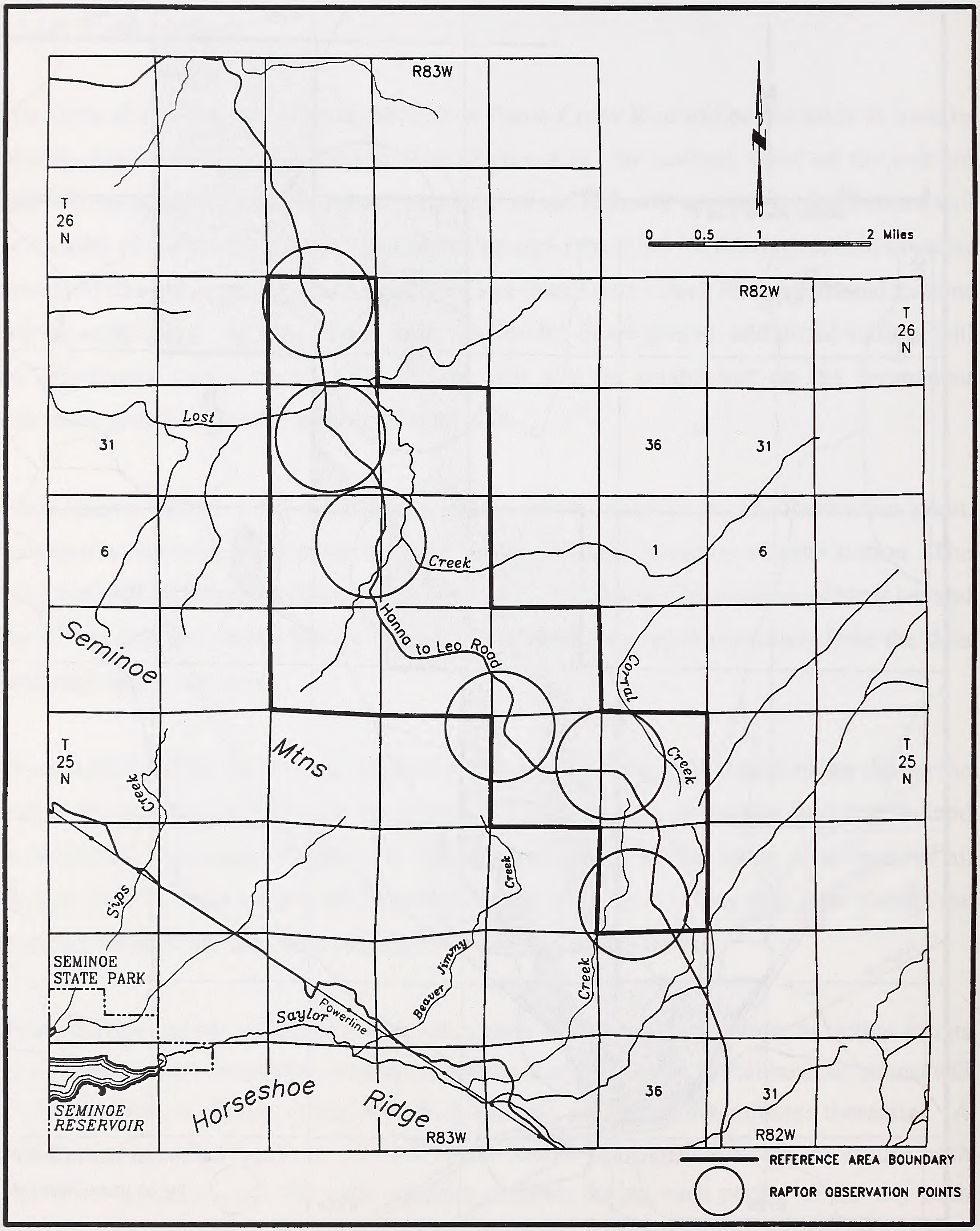


Figure 4.2 Approximate Locations of Raptor Observation Circles Within the Permanent Reference Area.

Table 4.1 Summary of Monitoring Protocol Components Showing the Timing, Location, and Frequency of Each Phase of the Study for 1995.

Survey/Study Description	Frequency	Timing	Location/Area
Raptor point count surveys	Biweekly winter, weekly otherwise	January - December	Foote Creek Rim and Simpson Ridge areas, reference area
Raptor nest surveys	One aerial survey, two ground surveys	April - August	Foote Creek Rim and Simpson Ridge areas, reference area and 10-mi (16-km) buffer
Avian species point count surveys	Three surveys	May - July	Foote Creek Rim and Simpson Ridge areas, reference area
Mountain plover surveys	Six surveys	May - July	Foote Creek Rim and Simpson Ridge areas, reference area
Big game aerial surveys	Bimonthly winter survey Parturition period survey	November - mid-April June	KPPA
Pellet county surveys	Twice a year	End of May, end of October	Foote Creek Rim and Simpson Ridge areas
Sage grouse lek surveys	Two aerial and three ground surveys	April	KPPA
Sage grouse use surveys	Once a year	July	Foote Creek Rim and Simpson Ridge areas
Lagomorph trend surveys	Once per year	July or August	Foote Creek Rim and Simpson Ridge areas, reference area, and 10-mi (16-km) buffer
Prairie dog surveys	Three transects per prairie dog town per year	July or August	Foote Creek Rim and Simpson Ridge areas, reference area and 10-mi (16-km) buffer
Ground squirrel surveys	One roadside survey per year	July or August	Foote Creek Rim and Simpson Ridge areas, reference area, and 10-mi (16-km) buffer
Carcass searches	Weekly	January - December	Where turbines become operational
Carcass removal trials	Once each season	January - December	Where turbines become operational
Carcass detectability trials	Once each season	January - December	Where turbines become operational

All raptor sightings will be recorded on the data sheets contained in Addendum A to this plan. A unique observation number will be assigned to each sighting. The date, time of observation, plot number, species, and distance from observer will be recorded. The type of survey (i.e., fixed point, traveling between points, other) will be identified. The observer will indicate whether the bird is within or outside the survey radius if seen during a fixed point survey. Weather information such as temperature, wind speed and direction, cloud cover, and precipitation will be recorded for each station visit. The field form will include codes to be used for identifying the bird to species, or to higher levels if the species is unidentifiable (e.g., unidentified buteo).

Location of first sighting, as well as direction of travel and distance from the observer, will be mapped in the field. Broad categories of flight behaviors (passing through the sampled area, courtship/pair bonding, foraging, aggressive interaction, etc.) will be recorded. Flight patterns (perched, soaring, flapping, gliding) will be recorded in the order identified. For example, if a raptor is first sighted while perched, and then leaves its perch and flies (flapping) out of the sampled area, then a "1" will be written in the box next to perching, and a "2" next to flapping. Estimates of flight height will be made. Classes of 0-26 ft (0-8 m), 26-184 ft (8-56 m), and >184 ft (56 m) will be used. These classes correspond to the height below, within, and above the space occupied by turbine rotors, respectively. Each height category flown by the raptor will be recorded, and the order in which flown will be identified. Observations will be related to the distance to unique habitat features (e.g., nesting sites, ridges, etc.). The habitat traversed by the raptor will be identified in a similar fashion. Any comments or unusual observations will be recorded in the comment section of the data form.

4.1.1.4 Data Analysis

Species lists will be generated by study period and study unit. The number of raptors seen during each point count survey will be standardized to a unit area and unit time searched. For example, if four raptors are seen during a 40-minute interval at a station with a viewing

area of 1.0 mi^2 (2.6 km^2), these data may be standardized to 4/1.0 mi^2 (2.6 km^2) = 4 raptors/mi^2 (1.5 raptors/km^2) during a 40-minute survey. For instantaneous counts, the number of raptors seen will be standardized by area searched and the number of instantaneous counts taken during the point count. For example, if at the same station, five instantaneous counts are taken during a 40-minute observation period, two raptors were present during the second instantaneous count, and one was present during the third instantaneous count, data may be standardized to [(2+1)/5]/1.0 mi^2 (2.6 km^2) = 0.6 raptors/mi^2 (0.2 raptors/km^2) per instantaneous count.

Data will be plotted to illustrate differences in raptor use between (1) seasons, (2) times of day, (3) stations, (4) study areas, and (5) pre- and post-construction periods. Randomization testing methods (Manly 1991) for repeated measures analysis of variance (Milliken and Johnson 1984) will be used to test for differences in raptor use and possible interactions between (1) seasons, (2) times of day, (3) study areas, and (4) pre- and post-construction time periods, using the statistical software packages SAS (SAS Institute 1988) and RT (Manly 1991).

Further information to guide placement of wind turbines will be obtained from analysis of the existing habitat and topographic data (e.g., habitat types, distance to canyons, distance to nests, etc.) collected from maps and related to the bird observations. Resource selection functions (Manly et al. 1993) will be derived from the information gathered for the location of each raptor observed and information on habitat available to the raptor within each study area. Habitats or other topographic variables positively or negatively related to raptor use will be identified.

4.1.2 Raptor Nest Census

4.1.2.1 Objective

The objective of the raptor nest census is to evaluate number and distribution of nesting raptors which may be potentially influenced by the project and to evaluate potential effects of the wind turbines on nesting parameters.

4.1.2.2 Introduction

It is assumed that the number and distribution of active nests within the area potentially impacted by the placement of wind turbines over time represents an index to the status of the breeding population of raptors. While all raptor species are of interest, nesting surveys will focus on the three species of most concern; the golden eagle, bald eagle, and ferruginous hawk. Since golden eagles are known to forage at least 10 mi (16 km) from a nest, it is also assumed that the zone influenced by the wind turbines extends approximately 10 mi (16 km) from the turbine strings. Thus, the study areas or nesting populations include the Foote Creek Rim and Simpson Ridge areas and the permanent reference area, and a 10-mi (16-km) buffer around each, excluding coniferous forests.

It is recognized that the number of occupied territories is more useful than occupied nests when evaluating breeding populations status. Inadequate data exist at present to allow an estimate of occupied territories. However, as data are accumulated over several years, estimates of nesting territory occupancy and other parameters that use the territory as the unit will be possible.

4.1.2.3 Field Methods

Study areas will be surveyed for raptor nests by helicopter during mid-April, when nesting activity of most raptors in the study areas will be well established. Helicopter surveys will be immediately followed by ground surveys to confirm the species and status of each observed nest. Surveys will be concentrated in likely raptor nesting habitat (e.g., rocky outcrops, cottonwood riparian zones, etc.). While all active raptor nests would be visited during the first ground survey, subsequent ground surveys will focus on the primary species of interest; golden eagle and ferruginous hawk [Bob Oakleaf, Rich Guenzel and Steve Tessmann, Wyoming Game and Fish Department (WGFD), personal communication]. Ground surveys will also be conducted in areas inaccessible by helicopter (e.g., Rock Creek Canyon) or where habitat features cause poor visibility from the air.

A 10-mi (16-km) buffer surrounding each study area will be surveyed. The buffer will include nests of pairs of birds most likely to use the area of interest (i.e., the site of turbine strings or a reference area). It is desirable to include an area containing at least 20 active golden eagle and 20 active ferruginous hawk nests; however, it is likely that 20 active nest for both these species will not be found within the combined survey area.

Regardless of species, all raptor nests located in each study area will be mapped on 7.5' topographic maps and located with a Geographic Positioning System (GPS). Data on habitat, nest status, and adult activity will also be recorded to the extent possible from the air. Nest data will be recorded on Bureau of Land Management (BLM) Nest History and Raptor Inventory data sheets (Addendum A).

All nests detected during the aerial survey will be visited once from the ground to verify location, species, and occupancy. For all golden eagle, bald eagle, and ferruginous hawk nests located, the approximate stage (e.g., nest building, incubating eggs, chicks, etc.) of the nest will be determined during the first visit to establish a date for a second visit. Two or

more additional ground visits will be made to all golden eagle, bald eagle, and ferruginous hawk nests to determine nest and territory parameters as described below.

4.1.2.4 Data Analysis

For all raptors, the number of occupied nests within the defined area will be used to estimate relative abundance of nesting species potentially affected by the wind turbines. For golden eagle, bald eagle, and ferruginous hawk, the following nest and territory parameters will be calculated:

- the total number of young fledged per active nest;
- the number of occupied nests/total number of nests checked;
- the number of reproductive pairs (with eggs)/number of total pairs (including those without eggs);
- the number of pairs that successfully fledge at least one young/number of reproductive pairs; and
- the number of young fledged/total number of pairs.

These parameters will be estimated to augment empirical data on nesting pairs. Statistical comparisons of these parameters (if sufficient data exist) will be made between study areas before and after construction (see Section 7.0 for description of statistical tests to be used). Statistical comparisons of these parameters will become more valuable as the territories become better defined.

4.2 NON-RAPTOR AVIAN SPECIES RELATIVE DENSITY AND USE

4.2.1 Point Count Surveys for Non-Raptor Avian Species

4.2.1.1 Objective

The objective of the point count surveys for non-raptor avian species is to estimate the species composition, relative abundance, and spatial use of the Foote Creek Rim and Simpson Ridge areas and a permanent reference area of the more common species and species of special interest (i.e., mountain plover) during the breeding season.

4.2.1.2 Introduction

Point count surveys will be used to estimate relative density and use for all non-raptor avian species during the breeding season on study areas. The intensity of the surveys insures sufficient data for some of the common species, but will provide only incidental data on less common and rare species, with the exception of the mountain plover. Thus, with the exception of the mountain plover and the most common species, impacts to non-raptor avian species will be based primarily on evidence of direct mortality. Point counts and productivity surveys will be intensified in historical mountain plover high use areas within the Foote Creek Rim area (see Section 4.3).

4.2.1.3 Field Methods

Three study areas will be used for point count surveys: the Foote Creek Rim area, the Simpson Ridge area, and a reference area. Point count surveys at each station will be replicated three times during the breeding season (mid-May to mid-July, weather dependent) a minimum of seven days apart. A grid of points will be established on each study area. The grid will consist of eight transects of five point count locations which run perpendicular to the long axis of each study area (Figure 4.3). Point count locations will be

established 1,312 ft (400 m) apart along the eight transects. The eight transects will be established equidistance apart along the long axis of the study area.

A variable circular plot method will be used for avian point count surveys (Reynolds et al. 1980; McDonald et al. 1993). Surveys will be conducted between the half hour before sunrise and four hours after sunrise. At each point, observers will count birds for eight minutes. Following the eight-minute count, the observer will move to the next point count location.

During the eight-minute count, observers will record all birds detected by sight or sound. Data recorded will include species of bird, number of birds in the group, estimated distance to the bird(s) out to a maximum of 328 ft (100 m), whether the bird(s) was seen within the first five minutes or last three minutes and the flight height class of the bird [0-26 ft (0-8 m), 26-184 ft (8-56 m), and >184 ft (56 m) above ground]. Mountain plover, raptors, waterfowl, sage grouse, and shore birds will be recorded at any distance, but distance estimates will not be attempted.

Two observers will be used each survey day. One observer will start at a randomly chosen point and move in ascending order for 20 points. The second observer will start at the twenty-first point from the randomly chosen start point and continue for 20 points with Point 1 following Point 40. In this fashion, all points at one plot will be visited once during a survey day, and each observer will visit 20 points. On the Simpson Ridge area, additional observers or survey days may be needed to cover all survey points.

4.2.1.4 Data Analysis

Observed density of each bird species will be calculated for each plot from the variable circular plot data. Relative density corrected for visibility bias (Buckland et al. 1993) will be estimated by species (if data are sufficient) using the program DISTANCE (Laake et al. 1993). Pooling of data across some species will be required when low numbers preclude

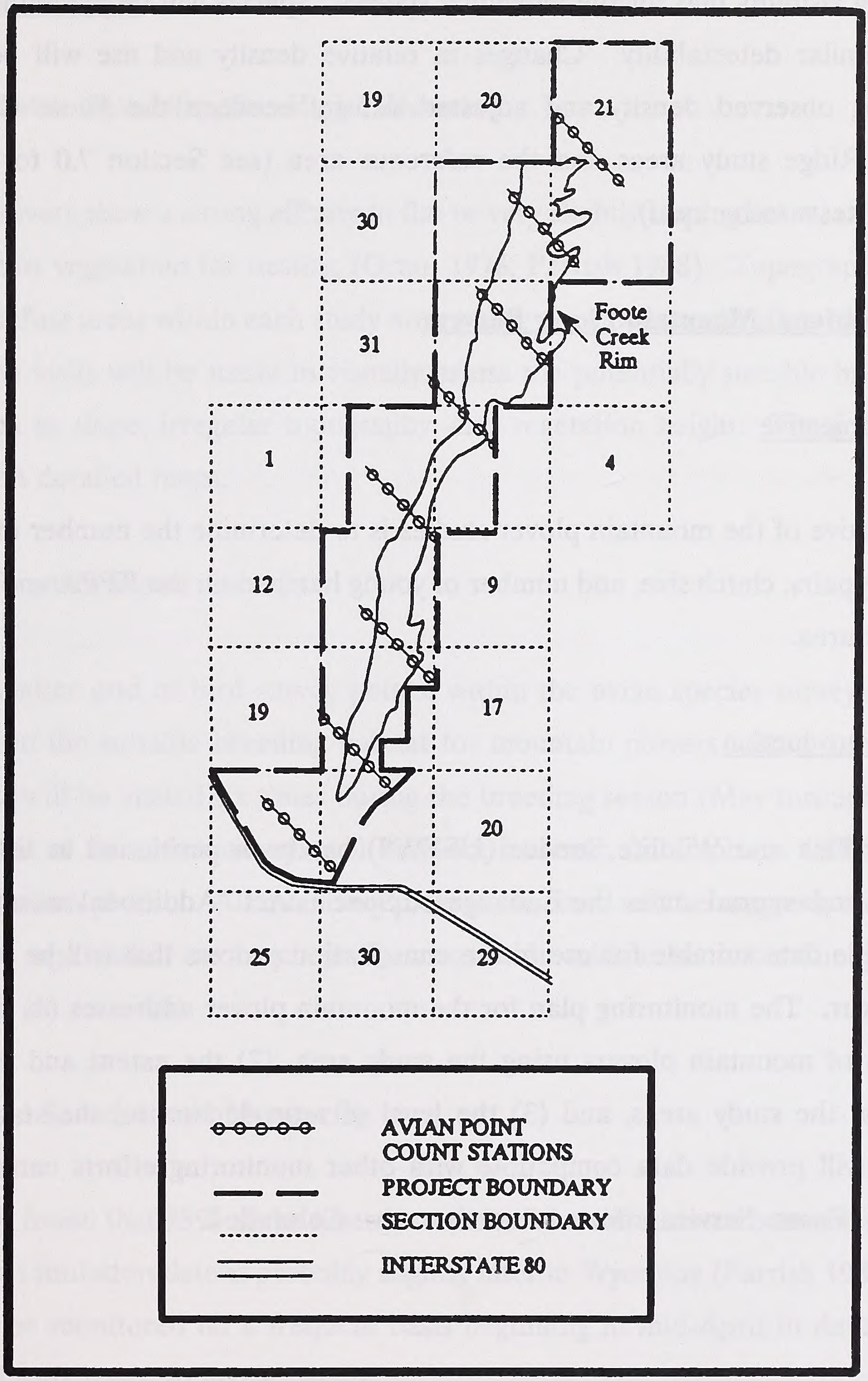


Figure 4.3 Approximate Avian Species Point Count Locations on Foote Creek Rim.

estimating visibility bias for the individual species. Species will be pooled into groups that exhibit similar detectability. Changes in relative density and use will be evaluated by comparing observed density and adjusted density between the Foote Creek Rim and Simpson Ridge study areas and the reference area (see Section 7.0 for description of statistical tests to be used).

4.2.2 Additional Mountain Plover Surveys

4.2.2.1 Objective

The objective of the mountain plover studies is to determine the number of birds, number of nesting pairs, clutch size, and number of young hatched on the KPPA and the permanent reference area.

4.2.2.2 Introduction

The U.S. Fish and Wildlife Service (USFWS) has been petitioned to list the mountain plover as endangered under the Endangered Species Act. Additional monitoring activities will provide data suitable for use in the consultation process that will be required should listing occur. The monitoring plan for the mountain plover addresses (1) detailed density estimates of mountain plovers using the study area, (2) the extent and use of breeding habitat on the study areas, and (3) the level of reproduction on the study areas. This protocol will provide data compatible with other monitoring efforts currently underway (e.g., U.S. Forest Service efforts in northeastern Colorado).

4.2.2.3 Field Methods

4.2.2.3.1 Habitat Suitability/Breeding Habitat

Mountain plovers show a strong affinity to flat or very slightly sloping areas, as well as areas with very short vegetation for nesting (Graul 1976, Parrish 1988). Topographic maps will be used to define areas within each study area where the slope would allow suitable habitat to exist. Site visits will be made to visually assess the potentially suitable habitat for key features such as slope, irregular topography, and vegetation height. These areas will be delineated on detailed maps.

4.2.2.3.2 Mountain Plover Surveys

A second smaller grid of bird survey points, within the avian species survey grid, will be established on the suitable breeding habitat for mountain plovers within the study areas. These points will be visited six times during the breeding season (May through July). The same methods as the avian surveys will be used; however, an emphasis will be placed on locating mountain plovers. All mountain plovers observed will be mapped, and additional data such as age (adult vs. hatch year), association with other mountain plovers, and behavior will be recorded.

4.2.2.3.3 Nest Searches and Monitoring

Graul (1975) found that 75% of the nests he monitored were initiated between April 25 and May 14. Nest initiation date is probably slightly later in Wyoming (Parrish 1988). Suitable habitat will be monitored on a frequent basis beginning in mid-April to determine when mountain plovers begin to arrive on-site.

Nest searches will begin in early May or when breeding behavior is observed. Efforts will be made to find all nests (including those for second clutches) on the study areas. The

location of each nest will be recorded on a detailed map of the study area. Each nest will be monitored on a three- to four-day rotation until the young have hatched and leave the nest. Surveyors will avoid disturbing the nest and pair as much as possible (e.g., observing from a vehicle and at long distances with a spotting scope).

4.2.2.3.4 Data Analysis

The proportion and amount of suitable breeding habitat for mountain plovers within each study area will be estimated. The habitat identified as suitable will be overlaid with the proposed development areas to determine the extent of habitat impacts.

The number of mountain plovers (and breeding pairs) using each study area will be calculated. Data from nest monitoring will be used to assess the reproductive effort of mountain plovers at the study sites. Mapped nest locations will be overlaid with other data (e.g., development area, turbine strings) to assess potential and extent of impacts. Hatching data, in conjunction with the bird surveys, will be used to estimate survivorship to fledgling, if feasible.

4.3 BIG GAME STUDIES

4.3.1 Objective

The primary objective of this study is to describe the temporal and spatial distribution, abundance, and habitat use of big game in and around the KPPA before and after construction of turbines, and using these data, to determine if the turbines have a displacement effect.

4.3.2 Introduction

It is assumed that the project may cause gross changes in distribution, and possibly, reduced habitat use and movements near areas where turbines are constructed. Aerial surveys will allow the determination of gross distribution and habitat use by big game during the winter and parturition periods. Pellet transects will allow a determination of seasonal use within areas of development. The design of pellet transects will allow the determination of use before and after construction as influenced by habitat features and distance to turbines. A fixed-wing aerial survey was selected because the pronghorn is the species of primary interest. Mule deer are most effectively counted using helicopter surveys, which would likely disturb pronghorn.

4.3.3 Aerial Surveys

4.3.3.1 Field Methods

Fixed-wing aerial surveys using a Piper Super Cub airplane (or similar aircraft) will be conducted to locate a sample of mule deer, pronghorn, and other big game groups in the study area. A single survey will be conducted during the parturition period (approximately the first of June) to estimate parturition period, number, and distribution. Surveys will be conducted every other week during the winter starting in November and continuing through April. The aerial surveys will be conducted within all of Hunt Area 46 plus the remainder of the Simpson Ridge area. North-south oriented line transects located systematically with a random starting point will be flown. Stratification of data post-construction will allow analysis of data at different distance classes from turbines.

The WGFD Pronghorn Survey Protocol will be followed with the possible exception that automated data entry/GPS equipment may be used. A GPS unit will be used to locate the starting and stopping points of each line. Once "on-line", the airplane will maintain a constant altitude. A laptop computer interfaced to the GPS will be used to record

continuous (every 10 seconds) latitudes and longitudes. When a group of animals is detected, latitude and longitude of the airplane will be captured when a line drawn from the airplane to the group is perpendicular to the transect. The observer (recorder) will record an observation number, species, number of animals, group composition, habitat type, and approximate perpendicular distance of the group from the transect. Comments and unusual observations will also be recorded.

Observer(s) will concentrate their efforts in a 0.6-mi (1.0-km) band on either side of the transect. Observations beyond the 0.6-mi (1.0-km) boundary may be recorded, but will be flagged to indicate they were outside this boundary.

Distance will be measured from the center of the sighting (e.g., individual pronghorn, groups of pronghorn) to the flight line along a perpendicular projection onto the flight line. To aid in estimating the perpendicular distance to groups of animals, clear window templates will be calibrated so that sightings viewed through them can be placed into discrete distance zones. The proper locations for the distance bands is dependent on altitude and will be determined using an inclinometer. Templates will be prepared with the observer's head in a fixed position relative to the window. Airspeed will depend on the habitat type. For example, airspeed in open prairie habitat will be greater than in other habitats where visibility of animals is lower.

4.3.3.2 Data Analysis

Relative density corrected for visibility bias (Buckland et al. 1993) will be estimated by each survey date for pronghorn and mule deer using the program DISTANCE (Laake et al. 1993). Locations of groups also will be mapped by month and by season. Habitat maps will be developed using existing data (e.g., information from available satellite imagery, WGFD habitat maps). These maps will be combined using a Geographic Information System (GIS) with group locations for determining habitat types by group. Animal visibility will likely be a function of group size and habitat, so the bias correction must be habitat-specific. Other

environmental variables (e.g., snow cover, distance to water) that may be related to selection will be obtained for each group.

Resource selection functions (Manly et al. 1993) will be derived from the information gathered for each group location and information for habitats available to the group throughout the KPPA. Information such as habitat types, snow depth, distance to roads, and distance to turbine locations will be determined from the available information. Logistic regression will be used to estimate relative probabilities of use as a function of habitat, topography, and other environmental variables (Pereira and Itami 1991).

4.3.4 Big Game Use Surveys Using Pellet Counts

4.3.4.1 Field Methods

Pellet counts will be conducted on the Foote Creek Rim and Simpson Ridge areas. Surveys will be conducted at the end of the summer/fall season (approximately the end of October) and the end of the winter/spring season (approximately at the end of April). A grid of points will be established on each study area. The grid will consist of 24 transects of ten 3.3-ft (1.0-m) radius circular plots which run perpendicular to the long axis of each study area (Figure 4.4). These permanent plot locations will be established approximately 820 ft (250 m) apart along the 24 transects. The 24 transects will be established equidistance apart along the long axis of the study area. Depending on the distribution of points relative to the turbine locations, additional plots may be established at varying distances from the turbines.

During field setup, all pellets will be removed from within each plot, guaranteeing only fresh pellets will be observed in subsequent surveys. During each survey, observers will count and remove the number of pellet-groups within the 3.3-ft (1.0-m) radius plot. For pellet-groups on the boundary of the 3.3-ft (1.0-m) radius circle, the following rule will be established for recording the group (Neff 1968): if over half of the pellet-group by horizontal surface area

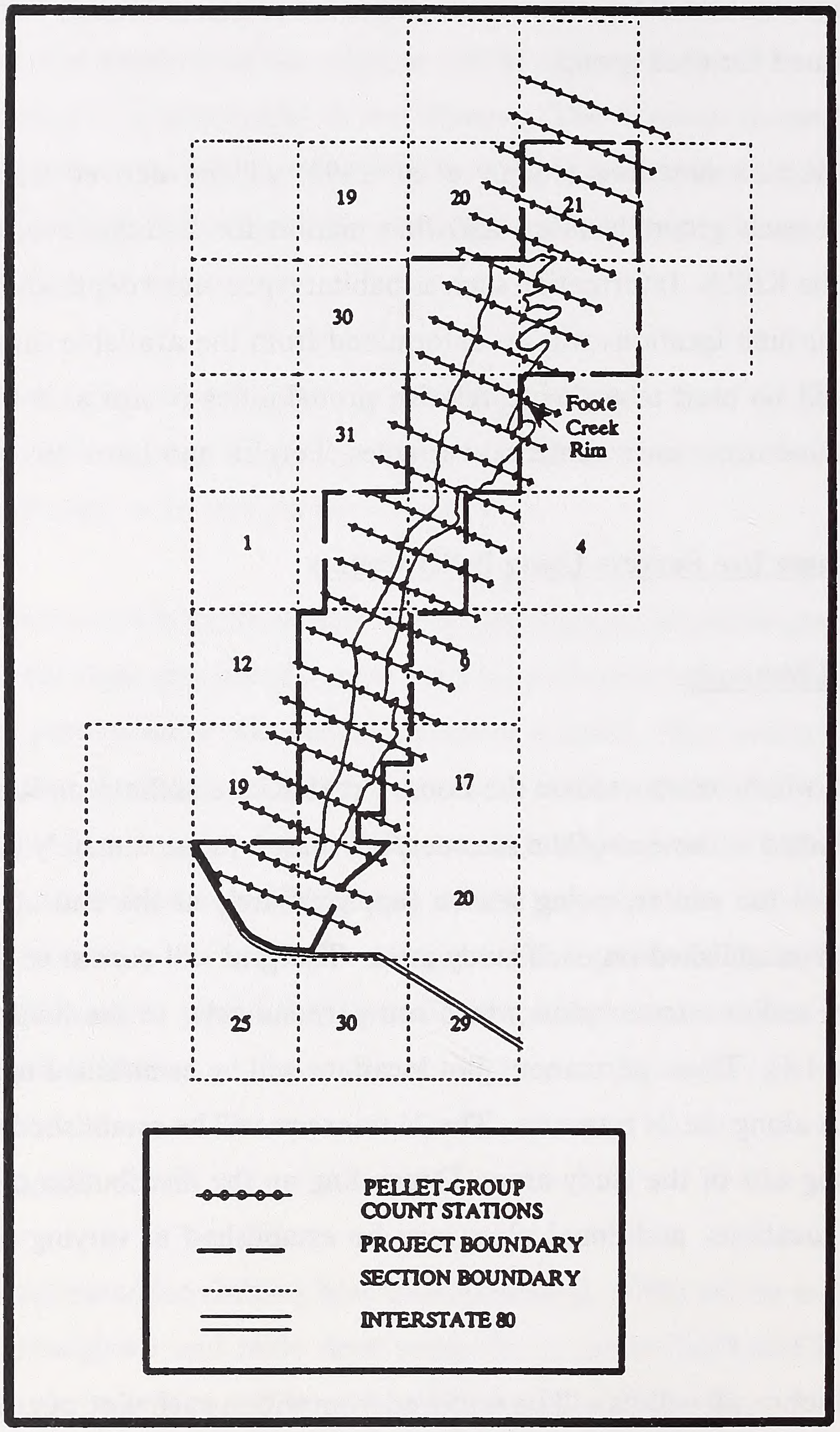


Figure 4.4 Approximate Locations for Big Game and Sage Grouse Pellet Count Transects near Foote Creek Rim.

is within the plot, the group is counted. If less than half of the pellet-group is within the plot, the group is not counted. For those pellet-groups that are half in and half out, every other group will be counted.

4.3.4.2 Data Analysis

Density of pellet groups by species will be calculated by season, study area, and habitat. Displacement effects will be evaluated by comparing the density of pellet groups as a function of distance from the turbines before and after construction. If there is a displacement effect, then the density of pellet groups within a certain distance from the turbines should decrease after construction relative to before construction (see Section 6.0 for description of statistical tests to be used).

4.4 SAGE GROUSE LEK AND USE SURVEYS

4.4.1 Introduction

The greatest concern for sage grouse is the potential effect of windpower on the breeding population within the KPPA. The size of breeding populations will be estimated pre- and post-construction by monitoring lek use on all historical and newly discovered leks. The use of seasonal habitats in areas where turbines are constructed is of secondary concern. Habitat use and distribution within areas where turbines are constructed will be determined from estimates of use as determined by avian point counts. In addition, some indication of use may be determined by noting sage grouse pellets within big game pellet plots discussed above.

4.4.2 Sage Grouse Lek Surveys

4.4.2.1 Objective

The objective of conducting sage grouse lek surveys is to monitor trends in sage grouse abundance and distribution over the KPPA prior to, during, and after construction of wind turbines.

4.4.2.2 Field Methods

A map of known historic and current sage grouse leks in the KPPA will be obtained from the WGFD. Two aerial surveys will be conducted in April 1995, approximately two weeks apart, to confirm existence and activity status of known leks and to search for additional leks. Once all active leks in the KPPA have been located and mapped, annual counts will be made to determine sage grouse abundance on leks. Sage grouse on leks, especially the cryptic hens, cannot accurately be counted from the air. Therefore, each lek will be visited three times during the month of April by foot or vehicle. During each visit, all grouse on the lek will be counted using binoculars and a spotting scope. Additional sage grouse lek trend data will be obtained from counts conducted by the WGFD in the KPPA in the 10-year period preceding construction.

4.4.2.3 Data Analysis

A map will be prepared each year showing location and mean number of birds attending each lek.

4.4.3 Sage Grouse Use Surveys

4.4.3.1 Objective

The objective of this survey is to determine relative sage grouse abundance and distribution by habitat in areas of planned development (the Foote Creek Rim and Simpson Ridge areas) within the KPPA.

4.4.3.2 Field Methods

Information on sage grouse use of the development sites within the KPPA outside of the breeding season will be collected by conducting sage grouse pellet counts. Counts will be conducted in July within the plots used for big game pellet-group counts. All sage grouse pellets or pellet groups left within the 3.3-ft (1.0-m) radius circular plot will be recorded and removed from the transect. Additional information on sage grouse use of the KPPA will be collected by obtaining results of annual sage grouse brood surveys conducted by the WGFD in July. These data will be collected for the 10-year period preceding construction.

4.4.3.3 Data Analysis

An index of relative density of sage grouse using the areas where turbines are constructed in the different habitats will be calculated from the density of pellet groups by season, study area, and habitat.

4.5 PREY AVAILABILITY STUDY

4.5.1 Objective

The objective of the prey availability studies is to determine an index of prey availability within a 10-mi (16-km) buffer of each of the three study areas (the Foote Creek Rim and

Simpson Ridge areas and the permanent reference area) and relate this index to differences in raptor use, breeding pair density, nest occupancy, and nest success between the study areas.

Three prey groups that are important to raptors will be studied: lagomorphs, prairie dogs, and ground squirrels.

4.5.2 Introduction

Little concern exists regarding potential effects of windpower on small mammals (e.g., prairie dogs and ground squirrels). However, an index to the relative abundance of these species within the range of raptors potentially affected by the project will be used to assist the interpretation of relative abundance and nesting parameter data for raptors. The index is based on an extensive measure of relative abundance of medium-sized mammals on and within 10 mi (16 km) of the Foote Creek Rim and Simpson Ridge areas, and the permanent reference area. The index is sensitive enough to demonstrate major changes in abundance (eruptions and crashes), but not minor changes in population density.

4.5.3 Field Methods

4.5.3.1 Lagomorphs

Trend counts as described in the Handbook of Biological Techniques (WGFD 1982) will be used to evaluate lagomorph abundance in the study areas. Five 20-mi (32-km) transects (one in the permanent reference area and four in the KPPA) along roads will be selected and sampled once in late July or early August. The transects will be distributed throughout the areas to provide adequate coverage of all habitat types. The transects will be driven at approximately 20 mph (32 kmph) beginning one half hour after sunset. All lagomorphs observed in the headlights of the vehicle will be counted, identified, and the mile point at

which they were observed recorded. Only one transect will be driven a night so that each transect is surveyed during peak activity hours for lagomorphs.

4.5.3.2 Prairie Dogs

All known prairie dog towns within a 10-mi (16-km) buffer of the Foote Creek Rim and Simpson Ridge areas, and the permanent reference area, based on WGFD maps, and any additional prairie dog towns detected during the big game and nest aerial surveys will be surveyed and mapped once during July or August of each year. To ensure that sample effort is approximately proportional to prairie dog town size, three transects 10 ft (3 m) wide, oriented north-south and equidistant apart will be located in each town. Observers will walk each transect measuring the distance as they go with a rolatape wheel and counting the number of active burrows within each transect. Active burrows will be defined by the presence of fresh scat within 1.6 ft (0.5 m) of the burrow entrance (Biggins et al. 1992). Burrows on the boundary of the transect will be counted if more than half of the burrow entrance is located within the transect (Biggins et al. 1992).

4.5.3.3 Ground Squirrels

An index to relative abundance of ground squirrels within a 10-mi (16-km) buffer of the Foote Creek Rim and Simpson Ridge areas, and the permanent reference area will be determined through roadside surveys once each year during July or August. All public roads within these areas will be mapped. A systematic sample of points along these roads will be selected. The observer will drive along predefined routes stopping at each systematically selected point. En route to each point, the observer will record the number of prairie dogs and ground squirrels (including road kills) seen within 164 ft (50 m) of the centerline on each side of the road in each mile segment of road. At each point the observer will randomly select the left or right side of the road, and search a 2.5 acre square plot on the selected side for the presence of active ground squirrel burrows. The observer will search the entire plot or until an active burrow is found. Active burrows will be defined by the

presence/absence of fresh scat or any other evidence of recent use within 1.6 ft (0.5 m) of the burrow entrance. Approximately 40 plots will be sampled in each study area.

Ground squirrel abundance and density will be evaluated in conjunction with the big game and sage grouse pellet count surveys to relate prey availability near turbines to raptor use. The number of active ground squirrel burrows within the plots used for big game and sage grouse pellet counts will be counted.

4.5.3.4 Data Analysis

Prey availability data will be evaluated to describe population trends in the three prey groups before and after construction of the wind turbines. The data will be evaluated in an effort to correlate raptor production and raptor use with prey availability.

4.6 CARCASS SEARCHES

4.6.1 Introduction

The primary indication of impact to individual birds is the estimation of mortality associated with turbines. All carcasses located within areas surveyed, regardless of species, will be recorded and a cause of death determined, if feasible. However, an estimate of total carcasses of avian species will be made by estimating scavenging and detectability bias.

4.6.2 Estimation of Avian Mortality

4.6.2.1 Objective

The objective of the carcass searches is to estimate extent of avian mortality associated with the wind turbines.

4.6.2.2 Methods

The Foote Creek Rim and Simpson Ridge areas will be used for carcass searches. Carcass searches will be initiated in each area when construction of wind turbines begins.

Two types of plots will be sampled: turbine strings and sections of electrical distribution lines. The size of the plots to be searched will be determined by the size of the area in which the operational turbines and distribution lines are located. That is, as turbine strings and distribution lines are constructed, they will be included in the area to be searched.

Once all turbine strings are operational, a systematic sample of the strings will be selected for searching on a given search day. Search plots will be rotated so that all turbine strings are searched on an equal basis. The area out to 197 ft (60 m) around each turbine string will be searched.

Once transmission lines are constructed, a systematic sample of 2,624-ft (800-m) sections will be selected for searching on a given search day. All electrical distribution lines within the boundary of the development area will be included. Search plots will be rotated so that each section of distribution line is searched on an equal basis. The area out to 98 ft (30 m) from the center line of distribution lines will be searched.

Biologists trained in search techniques will conduct the searches. Parallel transects will be established 33 ft (10 m) apart in the area to be searched [197 ft (60 m) in all directions of turbine strings and 98 ft (30 m) from the midline of each section of distribution lines]. A searcher will walk at a rate of approximately 197-295 ft (60-90 m) per minute along each transect searching both sides out to 16 ft (5 m) for casualties.

Searches of the selected turbine strings and electrical distribution lines will be conducted once a week to locate and collect any mortalities found under the turbines; however, casualties found at other times and places will also be collected and recorded. For all

casualties found, data recorded will include the species, sex if identifiable, age, date and time at which it was collected, the location of the casualty, condition of the casualty, and any comments which may indicate cause of death. All casualties located will be photographed as found and mapped on a detailed map of the study area which shows the location of the wind turbines and associated facilities such as power lines and towers.

All casualties found will be labelled with a unique number, bagged and frozen for future reference and possible necropsy. In absence of necropsy, sex and age will be determined, if feasible. A copy of the data sheet for each carcass will be maintained with the carcass at all times (i.e., bagged and frozen with the carcass).

4.6.2.3 Data Analysis

Casualties found will be used to document number and species of dead birds, to determine if birds were killed by the turbines, and to look for possible topographic or turbine characteristic effects.

4.6.3 Estimation of Carcass Removal by Scavengers

4.6.3.1 Objective

The objective of the scavenger carcass removal studies is to estimate the length of time avian mortalities remain in the search area.

4.6.3.2 Methods

Foote Creek Rim and the Simpson Ridge areas will be used for carcass removal studies. For each area, carcass removal trials will begin as soon as a string of wind turbines is complete. The size of the plot will be determined by the size of the area in which operational turbines are located.

Once each season, 20 carcasses of birds of two size classes [10 small passerines (e.g., house sparrow) and 10 medium-sized raptors (e.g., red-tailed hawk)] will be randomly placed within the study area. Maintenance personnel will be shown the location of the carcasses and instructed in the daily monitoring procedure. Each carcass will be checked once a day for seven days to determine scavenger removal rates. At the end of the seven-day trial, the carcasses that remain on the plot will be removed.

4.6.3.3 Data Analysis

Carcass removal rate will be expressed as the average length of time a carcass remains at the site before it is removed. The analyses will be used to evaluate effectiveness of the carcass searching effort and to estimate the number of carcasses missed because they are removed by scavengers before they can be located by search crews.

4.6.4 Estimation of Searcher Efficiency

4.6.4.1 Objective

The objective of the searcher efficiency trials is to estimate the percentage of avian mortalities found by searchers to evaluate searcher efficiency.

4.6.4.2 Methods

Foote Creek Rim and the Simpson Ridge areas will be used for searcher efficiency studies. For each area, searcher efficiency trials will begin when a string of wind turbines is complete. The size of the plot will be determined by the size of the area which is being searched for casualties.

Once each season, 20 carcasses of birds of two size classes [10 small passerines (e.g., house sparrow) and 10 medium-sized raptors (e.g., red-tailed hawk)] will be randomly placed

within the study area by personnel not involved in the carcass searches. In order to avoid increased scavenger rates and better mimic the likely number of carcasses expected at a given time, the trial will take place over a four-week period. Each week, five carcasses (alternating two and three per week from each size class) will be placed within the search area. Personnel conducting the searches will not know the location of the detectability carcasses. All carcasses will be placed at random locations within the areas being searched for avian mortality prior to the carcass search on the same day. Each carcass will be discreetly marked with tape around the leg so that it can be identified as a detectability carcass after it is found. The number and location of the detectability carcasses found during the carcass search will be recorded and the carcasses removed when they are found. Following the carcass search on the same day, the unrecovered carcasses will be picked up by personnel who are not involved in the carcass search and who know their location.

4.6.4.3 Data Analysis

Searcher effectiveness will be expressed as the average percentage of carcasses found by searchers. The analyses will be used to evaluate effectiveness of the carcass-searching effort.

5.0 DATA COMPILATION AND STORAGE

A database will be established to store, retrieve, and organize field observations. Data from field forms will be keyed into electronic data files using a pre-defined format that will make subsequent data analysis straightforward. All field data forms, field notebooks, and electronic data files will be retained for ready reference.

6.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC measures will be implemented at all stages of the study, including field data collection, data entry, and data analysis and report preparation. At the end of each survey day, each observer will be responsible for inspecting his or her data forms for completeness, accuracy, and legibility. At least weekly, the study team leader will review data forms to insure completeness and legibility, and any problems detected will be corrected. Any changes made to the data forms will be initialed by the person making the change.

Data will be double-entered into electronic files by two different technicians. These two files will be compared and any errors detected will be corrected by referencing the raw data forms and/or consultation with the observer(s) who collected the data. Any irregular codes detected, or any unclear or ambiguous data will be discussed with the observer and study team leader. All changes made to the raw data must be documented for future reference.

After the data have been double-keyed and verified, the study team leader or QA/QC technician will check a 5% sample of data forms against the final computer file.

Any problem data identified in later stages of analysis will be traced back to the raw data forms, and appropriate changes in all steps will be made.

7.0 DATA ANALYSIS

Some analysis procedures specific to a given study have been presented within the section describing the study. The following is a general description of the statistical tests which will be used for exploratory analysis of many variables and for making statistical comparisons among study areas and between pre- and post-construction data within study areas.

For all parameters, data will be plotted by survey date for the Foote Creek Rim and Simpson Ridge areas and the permanent reference area. For many of the parameters estimated (e.g., avian species use, breeding pair density, etc.), statistical comparisons will be made (1) between the Foote Creek Rim and Simpson Ridge areas, and the permanent reference area (both pre- and post-construction) and (2) between data collected pre- and post-construction within the study areas, using randomization tests (Manly 1991) and the computer package RT (Manly 1991). Significance levels (i.e., p-values) will be reported, and those below $\alpha=0.10$ (one-tailed) will be judged as significant.

For all tests of hypotheses, the power (probability of concluding a difference between two study areas) will be calculated for various effect sizes based on baseline studies and initial data collected during monitoring, as soon as data allow for estimates of variance. The power of the test to detect an effect is a function of the sample size, the size of the test (α), estimates of variance, and the magnitude of the effect. For variables measured as proportions (e.g., reproductive success), power can be calculated using the large sample normal theory. For example, with 20 active nests on the reference and development area, $\alpha=0.05$ (one-tailed), and with a reference reproductive success rate of 90%, the power to detect a 40% decline relative to the reference is about 75%. Under these conditions the power to detect a 50% decline is 85%. With a reference reproductive success rate of 80%, the power to detect a 40% decline is 50%, and the power to detect a 50% decline is 75%. With a reference reproductive success rate of 70%, the power to detect a 40% decline is 45%, and the power to detect a 50% decline is 65%. With a reference reproductive success rate of 60%, the power to detect a 40% decline is 35%, and the power to detect a 50%

decline is 48%. By increasing the significance level α, or the Type I error rate (i.e., concluding an effect exists when, in fact, there is no effect), power increases. For example, with $\alpha = 0.10$, and with a reference reproductive success rate of 80%, the power to detect a 40% decline is 70%, and the power to detect a 50% decline is 86%.

8.0 DISPOSITION OF DATA

This monitoring program will provide data to the U.S. Department of the Interior BLM for their use in evaluating the initial phase of development and subsequent developments. Cooperating agencies will be provided copies of the annual reports by December 31 each year. Nest locations, nest status, and other raw data will be provided to cooperating agencies upon request. USFWS will also be notified immediately in the event that any individual of an endangered or threatened species is taken.

A technical committee made up of experts from the cooperating agencies and KENETECH representatives will be established to meet and discuss the results of the monitoring studies and evaluate methodology. The need for further study will be based on reasonable criteria proposed by the technical committee. The decision to conduct more detailed study will be based on reasonable criteria proposed by the technical committee and confirmed by the BLM in consultation with the cooperating agencies and KENETECH. The technical committee will meet annually during the month of January and at other times, based on need.

9.0 SUMMARY

Wildlife use of the Foote Creek Rim area will be monitored relative to the reference area(s) for the baseline year and several years after construction. Additional surveys of wildlife use will be conducted as new areas are brought on line with wind turbines. The nesting territories for raptor species of special interest within suitable habitat surrounding the turbine strings will be monitored for occupancy and success. Seasonal distribution and habitat use of big game will be monitored to evaluate the effects of wind turbines on these populations. Project effects on sage grouse populations will be evaluated through lek and use surveys. Raptor prey densities (lagomorph, prairie dogs, ground squirrels) will be monitored to aid in explaining variation in raptor use and nest parameters due to prey population fluctuations. Upon project start-up, the area surrounding each turbine string and associated power lines will be monitored for carcasses resulting from collisions with turbines and associated structures.

The need to monitor a specific development site beyond the initial period (e.g., three to five years post-construction) will be determined based on an evaluation of the results of the monitoring studies. Additional studies or adjustments in the protocols may be made within the baseline period.

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ADDENDUM A:

DRAFT DATA SHEETS

RAPTOR OBSERVATION DATA SHEET PAGE___OF_____

DATE: ______________ LOCATION (circle one): FCR SR REF STATION NO.: _______________ OBSERVER: _____________
SURVEY TYPE (circle one) 1. fixed point (40 min) 2. instantaneous count 3. incidental START TIME: ________ END TIME:__________
WEATHER: PRECIP:_______ CLOUD COVER:_________ TEMP:_________ WIND DIRECTION:_______ WIND SPEED:_____
GENERAL COMMENTS:____

Obs. #	Time	Species	# of Ind.	Distance from Observer	Activity[1]	Behavior[2]	Flight Height[3]	Direction of Flight	Habitat Traversed	Notes

[1] Activity: P=perched, S=soaring, F=flapping, G=gliding O=other (specify).
[2] Behavior: C=courtship H=hunt A=aggressive interaction O=other (specify).
[3] Flight height: 1 = 0-8 m, 2 = 8-56 m, 3 > 56 m.

AVIAN SPECIES SURVEY DATA SHEET PAGE ____ OF ____

DATE:______________ LOCATION (circle one): FCR SR REF STATION NO.: _______________ OBSERVER:_______________
SURVEY TYPE (circle one) 1. fixed point (40 min) 2. instantaneous count 3. incidental START TIME: ________ END TIME:___________
WEATHER: PRECIP:________ CLOUD COVER:_________ TEMP:_________
WIND DIRECTION:________ WIND SPEED:__________
GENERAL COMMENTS:____

Station Number	1st 5 min.[1]	Last 3 min.[2]	Species	# of ind.	Distance from observer	Activity[3]	Flight Height[4]	Direction of flight	Notes

1 Record a check (√) for observations taken during the first five minutes of the eight minute period
2 Record a check (√) for observations taken during the last three minutes of the eight minute period
3 Activity: P=perched, S=soaring, F=flapping, G=gliding O=other (specify)
4 Flight height: 1 = 0-8 m, 2 = 8-56 m, 3 > 56 m.

PELLET COUNT DATA SHEET

DATE:________________ LOCATION(circle one): FCR SR PAGE _______ OF ________
OBSERVER:____________ START TIME:__________________ END TIME:________________

WEATHER: PRECIP:___________ CLOUD COVER:___________ TEMP:________________
WIND DIRECTION:______________ WIND SPEED:________________
GENERAL COMMENTS:____

Transect Number	Plot Number	Species	Number of Pellet Groups	Notes

SAGE GROUSE LEK SURVEY DATA SHEET PAGE ___ OF ___

DATE:______________ LOCATION(circle one): FCR SR
OBSERVER:____________ START TIME:_________ END TIME:_________
SURVEY TYPE (circle one) Aerial Ground Incidental
WEATHER: PRECIP:__________ CLOUD COVER:___________ TEMP:____________
WIND DIRECTION:____________ WIND SPEED:______________
GENERAL COMMENTS:____
____

Lek Identification	Time	Number of males	Number of females	Notes

LAGOMORPH TREND COUNT DATA SHEET

DATE:_________________ LOCATION(circle one): FCR SR REF PAGE ___ OF ___
OBSERVER:_________________ START TIME:_______________ END TIME:_______________
WEATHER: PRECIP:__________ CLOUD COVER:__________ TEMP:__________
WIND DIRECTION:__________ WIND SPEED:__________
GENERAL COMMENTS:____
____

Mile Point	Time	Species	Number of Individuals	Notes

PRAIRIE DOG TRANSECT COUNT DATA SHEET

DATE:_______________ LOCATION(circle one): FCR SR REF PAGE ___ OF ___
OBSERVER:____________ START TIME:_________ END TIME:_________
WEATHER: PRECIP:__________ CLOUD COVER:__________ TEMP:__________
WIND DIRECTION:__________ WIND SPEED:__________
GENERAL COMMENTS:____

Prairie Dog Town Identification	Transect Number	Number of Active Burrows	Length of Transect	Notes

GROUND SQUIRREL BURROW COUNT DATA SHEET

DATE:_______________ LOCATION(circle one): FCR SR REF PAGE ___ OF ___
OBSERVER:____________ START TIME:_________ END TIME:_________
WEATHER: PRECIP:_________ CLOUD COVER:_________ TEMP:_________
WIND DIRECTION:_________ WIND SPEED:__________
GENERAL COMMENTS:____

Transect Number	Plot Number	Species	Number of Active Burrows	Notes

GROUND SQUIRREL TREND COUNT DATA SHEET

DATE:______________ LOCATION(circle one): FCR SR REF PAGE ___ OF ___
OBSERVER:_____________ START TIME:_________ END TIME:_________
WEATHER: PRECIP:_________ CLOUD COVER:_________ TEMP:_________
WIND DIRECTION:__________ WIND SPEED:__________
GENERAL COMMENTS:____

Route Id.	Mile Segment	Species	Number of Live Ind.	Number of Road Kills	Selected Point	L or R Side	Presence of Active Burrows (Yes/No)	Notes

CARCASS SEARCH DATA SHEET

DATE:________________ PAGE ___ OF ___

LOCATION(circle one): FCR SR

OBSERVER:__________________________________

WEATHER: PRECIP:__________ CLOUD COVER:__________ TEMP:__________
WIND DIRECTION:__________ WIND SPEED:__________

GENERAL COMMENTS:____
____
____

Search Location: ____

Search Begin Time: ____

Search End Time: ____

Number of Casualties Found: ____

Number of Detectabilities Found: ____

CASUALTY INFORMATION DATA SHEET

DATE: ________________ PAGE ___ OF ___

LOCATION(circle one): FCR SR REF

OBSERVER: ______________________________

WEATHER: PRECIP:________ CLOUD COVER:__________ TEMP:_________
WIND DIRECTION:__________ WIND SPEED:__________

GENERAL COMMENTS:______________________________
____

Species:______________________________

Sex (if known): ______________________ Age (if known): ______________

Time Collected: ______________________________

Location Collected (provide details of location): ______________________________
____
____
____

Condition of Casualty (provide details): ______________________________
____
____
____

Comments (cause of death, evidence of scavenging, etc.): ______________________________
____
____
____
____
____
____

Photograph(s) number: ______________________________

Freezer where stored: ______________________________

Date Stored in Freezer: ______________________ Time Stored in Freezer: ______________

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management

RAPTOR INVENTORY DATA SHEET

Observer: ______________________ Nest Number: ______________________

Date of Observ.: ____________________ Species: ____________________

Land Ownership P S BLM T.____R.____Sec.______¼______¼____

Description of Nest Site: Latitude: ______________________

Nest Substrate: ________________ Longitude: ______________________

Height of Substrate: ______________ UTM________/__________/__________

Nest Ht. Above Ground: __________ Remarks, Physical Relationship to Other Nests:

Exposure: ________________ ________________

Elevation: ________________ ________________

Vegetative Type: ________________ ________________

Condition of Nest: ________________ ________________

Location of slide/photo: ____________ ________________

________________ ________________

Quad Name: ____________________________________

Record Nest Activity on Reverse Side:

MAP

NEST HISTORY

NEST NUMBER: ____________

YEAR	DATE	STATUS	CONDITION	EGGS	YOUNG	REMARKS

APPENDIX C:
PLANT SPECIES LIST

Plant Species List

Common Name	Scientific Name
Trees	
Subalpine fir	*Abies lasiocarpa*
Rocky mountain maple	*Acer glabrum*
Englemann spruce	*Picea englemannii*
Ponderosa pine	*Pinus ponderosa*
Narrowleaf cottonwood	*P. angustifolia*
Eastern cottonwood	*P. deltoides*
Quaking aspen	*Populus tremuloides*
Douglas-fir	*Pseudotsuga menziesii* var. *glauca*
Shrubs	
Serviceberry	*Amelanchier* spp.
Silver sagebrush	*Artemisia cana*
Black sagebrush	*A. nova*
Birdfoot sagebrush	*A. pedatifida*
Bud sagebrush	*A. spinescens*
Big sagebrush	*A. tridentata*
Basin big sagebrush	*A. tridentata* var. *tridentata*
Wyoming big sagebrush	*A. tridentata* var. *wyomingensis*
Saltbush	*Atriplex* spp.
Gardner's saltbush	*A. gardneri*
Barberry	*Berberis thunbergii*
Mountain mahogany	*Cercocarpus montanus*
Rabbitbrush	*Chrysothamnus* spp.
Low rabbitbrush	*C. humilis*
Rubber rabbitbrush	*C. nauseosus*
Douglas rabbitbrush	*C. viscidiflorus*
Dogwood	*Cornus* sp.
Licorice	*Glycyrrhiza lepidota*

Plant Species List (Continued)

Common Name	Scientific Name
Common juniper	*Juniperus communis* var. *depressa*
Winterfat	*Krascheninnikovia lanata*
Oregon grape	*Mahonia repens*
Common chokecherry	*Prunus virginiana* var. *melanocarpa*
Antelope bitterbrush	*Purshia tridentata*
Ribes	*Ribes* spp.
Wood's rose	*Rosa woodsii*
Raspberry	*Rubus* sp.
Willow	*Salix* spp.
Elderberry	*Sambucus* sp.
Black greasewood	*Sarcobatus vermiculatus*
Snowberry	*Symphoriocarpus* spp.
Forbs	
Yarrow	*Achillea millefolium* var. *lanulosa*
Onion	*Allium* sp.
Pussy-toes	*Antennaria* sp.
Columbine	*Aquilegia* sp.
Arnica	*Arnica* sp.
Fringed sage	*Artemisia frigida*
Showy milkweed	*Asclepias speciosa*
Aster	*Aster* spp.
Milkvetch	*Astragalus* spp.
Bun milkvetch	*A. simplificifolius*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Indian paintbrush	*Castilleja* sp.
Canada thistle	*Cirsium arvense*
Hound's tongue	*Cynoglossum officinale*
Horsetail	*Equisetum* spp.

Plant Species List (Continued)

Common Name	Scientific Name
Buckwheat	*Eriogonum umbellatum*
Wintergreen	*Gaultheria humifusa*
Wild geranium	*Geranium* spp.
Curlycup gumweed	*Grindelia squarrosa*
Golden aster	*Heterotheca* sp.
Biscuitroot	*Lomatium* sp.
Lupine	*Lupinus* spp.
Stemmy goldenweed	*Oonopsis multicaulis*
Plains prickly pear	*Opuntia polyacantha* var. *polyacantha*
Beardtongue	*Penstemon* sp.
Phlox	*Phlox* spp.
Plantain	*Plantago* sp.
Bracken fern	*Pteridium aquilinum* var. *latiusculum*
Dock	*Rumex* spp.
Stonecrop	*Sedum* sp.
Ute lady's tresses	*Spiranthes diluvialis*
Sea blite	*Suaeda* sp.
Common dandelion	*Taraxicum officinale*
Mountain pea	*Thermopsis montana*
Red clover	*Trifolium pratense*
Cattail	*Typha* spp.
Vetch	*Vicia* spp.
Violet	*Viola* spp.
Woody aster	*Xylorhiza glabriuscula*
Grasses and graminoids	
Brome	*Bromus* spp.
Smooth brome	*B. inermis*
Sedges	*Carex* spp.

Plant Species List (Continued)

Common Name	Scientific Name
Spike rush	*Eleocharis* sp.
Wild rye	*Elymus* spp.
Bottlebrush squirreltail	*E. elymoides*
Thickspike wheatgrass	*E. lanceolatus*
Western wheatgrass	*E. smithii*
Bluebunch wheatgrass	*E. spicatus*
Idaho fescue	*Festuca idahoensis*
Foxtail barley	*Hordeum jubatum*
Rushes	*Juncus* spp.
Junegrass	*Koeleria* sp.
Contracted Indian ricegrass	*Oryzopsis contracta*
Indian ricegrass	*O. hymenoides*
Bluegrass	*Poa* spp.
Sandberg bluegrass	*P. secunda*
Timothy	*Phleum* sp.
Alkali sacaton	*Sporobolus airoides*
Needlegrass	*Stipa* spp.
Needle-and-thread grass	*S. comata*

APPENDIX D:

ANIMAL SPECIES LIST

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1]

Common Name	Scientific Name
Mammals[2]	
Masked shrew	*Sorex cinereus*
Dusky shrew	*S. monticolus*
Water shrew	*S. palustris*
Merriam's shrew	*S. merriami*
Little brown myotis	*Myotis lucifugus*
Long-legged myotis	*M. volans*
Silver-haired bat	*Lasionycteris noctivagans*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Mountain (Nuttall's) cottontail[3]	*Sylvilagus nuttallii*
Desert cottontail[3]	*S. audubonii*
White-tailed jackrabbit[3]	*Lepus townsendii*
Least chipmunk[3]	*Tamias minimus*
Yellow-bellied marmot	*Marmota flaviventris*
Wyoming ground squirrel[3]	*Spermophilus elegans*
Thirteen-lined ground squirrel[3]	*S. tridecemlineatus*
Golden-mantled ground squirrel	*S. lateralis*
White-tailed prairie dog[3]	*Cynomys leucurus*
Red squirrel	*Tamiasciurus hudsonicus*
Northern pocket gopher	*Thomomys talpoides*
Olive-backed pocket mouse	*Perognathus fasciatus*
Ord's kangaroo rat	*Dipodomys ordii*
Beaver[3]	*Castor canadensis*
Western harvest mouse	*Reithrodontomys megalotis*
Deer mouse	*Peromyscus maniculatus*
White-footed mouse	*P. leucopus*
Northern grasshopper mouse	*Onychomys leucogaster*
Bushy-tailed woodrat	*Neotoma cinerea*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Heather vole	*Phenacomys intermedius*
Montane vole	*Microtus montanus*
Long-tailed vole	*M. longicaudus*
Prairie vole	*M. ochrogaster*
Sagebrush vole	*Lemmiscus curtatus*
Muskrat[3]	*Ondatra zibethicus*
Western jumping mouse	*Zapus princeps*
Porcupine[3]	*Erethizon dorsatum*
Coyote[3]	*Canis latrans*
Red fox[3]	*Vulpes vulpes*
Swift fox	*V. velox*
Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Ermine	*Mustela erminea*
Long-tailed weasel	*M. frenata*
Black-footed ferret	*M. nigripes*
Mink	*M. vison*
Badger[3]	*Taxidea taxus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk[3]	*Mephitis mephitis*
Mountain lion	*Felis concolor*
Bobcat	*F. rufus*
Elk[3]	*Cervus elaphus*
Mule deer[3]	*Odocoileus hemionus*
White-tailed deer[3]	*O. virginianus*
Moose	*Alces alces*
Pronghorn[3]	*Antilocapra americana*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Birds[4]	
Common loon[3]	*Gavia immer*
Pied-billed grebe[3]	*Podilymbus podiceps*
Horned grebe	*Podiceps auritus*
Eared grebe	*P. nigricollis*
Western grebe	*Aechmophorus occidentalis*
Clark's grebe	*A. clarkii*
American white pelican[3]	*Pelecanus erythrorhynchos*
Double-crested cormorant[3]	*Phalacrocorax auritus*
American bittern	*Botaurus lentiginosus*
Great blue heron[3]	*Ardea herodias*
Snowy egret	*Egretta thula*
Cattle egret	*Bubulcus ibis*
Green-backed heron	*Butorides striatus*
Black-crowned night-heron	*Nycticorax nycticorax*
White-faced ibis[3]	*Plegadis chihi*
Tundra swan	*Cygnus columbianus*
Trumpeter swan	*C. buccinator*
Snow goose[3]	*Chen caerulescens*
Canada goose[3]	*Branta canadensis*
Wood duck	*Aix sponsa*
Green-winged teal[3]	*Anas crecca*
Mallard[3]	*A. platyrhynchos*
Northern pintail[3]	*A. acuta*
Blue-winged teal[3]	*A. discors*
Cinnamon teal[3]	*A. cyanoptera*
Northern shoveler[3]	*A. clypeata*
Gadwall[3]	*A. strepera*
American wigeon[3]	*A. americana*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Canvasback[3]	*Aythya valisineria*
Redhead[3]	*A. americana*
Ring-necked duck[3]	*A. collaris*
Lesser scaup[3]	*A. affinis*
Common goldeneye	*Bucephala clangula*
Bufflehead[3]	*B. albeola*
Hooded merganser	*Lophodytes cucullatus*
Common merganser[3]	*Mergus merganser*
Red-breasted merganser	*M. serrator*
Ruddy duck	*Oxyura jamaicensis*
Turkey vulture[3]	*Cathartes aura*
Osprey[3]	*Pandion haliaetus*
Bald eagle[3]	*Haliaeetus leucocephalus*
Northern harrier[3]	*Circus cyaneus*
Sharp-shinned hawk[3]	*Accipiter striatus*
Cooper's hawk	*A. cooperii*
Northern goshawk[3]	*A. gentilis*
Broad-winged hawk[3]	*Buteo platypterus*
Swainson's hawk[3]	*B. swainsoni*
Red-tailed hawk[3]	*B. jamaicensis*
Ferruginous hawk[3]	*B. regalis*
Rough-legged hawk[3]	*B. lagopus*
Golden eagle[3]	*Aquila chrysaetos*
American kestrel[3]	*Falco sparverius*
Merlin[3]	*F. columbarius*
Peregrine falcon[3]	*F. peregrinus*
Prairie falcon[3]	*F. mexicanus*
Blue grouse[3]	*Dendragapus obscurus*
Sage grouse[3]	*Centrocercus urophasianus*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Wild turkey	*Meleagris gallopavo*
Virginia rail[3]	*Rallus limicola*
Sora	*Porzana carolina*
American coot[3]	*Fulica americana*
Sandhill crane[3]	*Grus canadensis*
Whooping crane	*G. americana*
Black-bellied plover	*Pluvialis squatarola*
Lesser golden plover	*P. dominica*
Western snowy plover	*Charadrius alexandrinus nivosus*
Semipalmated plover[3]	*C. semipalmatus*
Killdeer[3]	*C. vociferus*
Mountain plover[3]	*C. montanus*
Black-necked stilt	*Himantopus mexicanus*
American avocet[3]	*Recurvirostra americana*
Greater yellowlegs[3]	*Tringa melanoleuca*
Lesser yellowlegs	*T. flavipes*
Solitary sandpiper	*T. solitaria*
Willet	*Catoptrophorus semipalmatus*
Spotted sandpiper[3]	*Actitus macularia*
Upland sandpiper[3]	*Bartramia longicauda*
Long-billed curlew	*Numenius americanus*
Marbled godwit	*Limosa fedoa*
Sanderling	*Calidris alba*
Semipalmated sandpiper	*C. pusilla*
Western sandpiper	*C. mauri*
Least sandpiper	*C. minutilla*
Baird's sandpiper	*C. bairdii*
Pectoral sandpiper	*C. melanotos*
Stilt sandpiper	*C. himantopus*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Long-billed dowitcher[3]	*Limnodromus scolopaceus*
Common snipe[3]	*Gallinago gallinago*
Wilson's phalarope[3]	*Phalaropus tricolor*
Red-necked phalarope	*P. lobatus*
Franklin's gull[3]	*Larus pipixcan*
Bonaparte's gull	*L. philadelphia*
Ring-billed gull	*L. delawarensis*
California gull[3]	*L. californicus*
Herring gull	*L. argentatus*
Caspian tern[3]	*Sterna caspia*
Forster's tern	*S. forsteri*
Black tern	*Chlidonias niger*
Rock dove[3]	*Columba livia*
Mourning dove[3]	*Zenaida macroura*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Barn owl	*Tyto alba*
Eastern screech owl	*Otus asio*
Great horned owl[3]	*Bubo virginianus*
Western burrowing owl	*Athene cunicularia hypugea*
Long-eared owl	*Asio otus*
Short-eared owl[3]	*A. flammeus*
Northern saw-whet owl[3]	*Aegolius acadicus*
Common nighthawk[3]	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
White-throated swift	*Aeronautes saxatalis*
Broad-tailed hummingbird[3]	*Selasphorus platycercus*
Rufous hummingbird	*S. rufus*
Belted kingfisher[3]	*Ceryle alcyon*
Lewis' woodpecker	*Melanerpes lewis*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Red-headed woodpecker[3]	*Melanerpes erythrocephalus*
Red-naped sapsucker	*Sphyrapicus nuchalis*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker[3]	*P. villosus*
Northern flicker[3]	*Colaptes auratus*
Olive-sided flycatcher[3]	*Contopus borealis*
Western wood-pewee[3]	*C. sordidulus*
Willow flycatcher[3]	*Empidonax traillii*
Least flycatcher[3]	*E. minimus*
Hammond's flycatcher[3]	*E. hammondii*
Dusky flycatcher[3]	*E. oberholseri*
Cordilleran flycatcher	*E. occidentalis*
Say's phoebe[3]	*Sayornis saya*
Ash-throated flycatcher	*Myiarchus cinerascens*
Western kingbird[3]	*Tyrannus verticalis*
Eastern kingbird[3]	*T. tyrannus*
Horned lark[3]	*Eremophila alpestris*
Purple martin[3]	*Progne subis*
Tree swallow[3]	*Tachycineta bicolor*
Violet-green swallow[3]	*T. thalassina*
Northern rough-winged swallow[3]	*Stelgidopteryx serripennis*
Bank swallow	*Riparia riparia*
Cliff swallow[3]	*Hirundo pyrrhonota*
Barn swallow[3]	*H. rustica*
Gray jay[3]	*Perisoreus canadensis*
Steller's jay	*Cyanocitta stelleri*
Blue jay	*C. cristata*
Scrub jay	*Aphelocoma coerulescens*
Pinyon jay[3]	*Gymnorhinus cyanocephalus*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Clark's nutcracker[3]	*Nucifraga columbiana*
Black-billed magpie[3]	*Pica pica*
American crow[3]	*Corvus brachyrhynchos*
Common raven[3]	*C. corax*
Black-capped chickadee[3]	*Parus atricapillus*
Mountain chickadee[3]	*P. gambeli*
Chestnut-backed chickadee[3]	*P. rufescens*
Plain titmouse[3]	*P. inornatus*
Bushtit	*Psaltriparus minimus*
Red-breasted nuthatch[3]	*Sitta canadensis*
White-breasted nuthatch[3]	*S. carolinensis*
Pygmy nuthatch	*S. pygmaea*
Brown creeper	*Certhia americana*
Rock wren[3]	*Salpinctes obsoletus*
Canyon wren	*Catherpes mexicanus*
Bewick's wren	*Thryomanes bewickii*
House wren[3]	*Troglodytes aedon*
Marsh wren	*Cistothorus palustris*
American dipper	*Cinclus mexicanus*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet[3]	*R. calendula*
Blue-gray gnatcatcher[3]	*Polioptila caerulea*
Eastern bluebird[3]	*Sialia sialis*
Western bluebird	*S. mexicana*
Mountain bluebird[3]	*S. currucoides*
Townsend's solitaire[3]	*Myadestes townsendi*
Veery[3]	*Catharus fuscescens*
Swainson's thrush	*C. ustulatus*
Hermit thrush[3]	*C. guttatus*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
American robin[3]	*Turdus migratorius*
Gray catbird	*Dumetella carolinensis*
Northern mockingbird	*Mimus polyglottos*
Sage thrasher[3]	*Oreoscoptes montanus*
Brown thrasher	*Toxostoma rufum*
American pipit[3]	*Anthus rubescens*
Bohemian waxwing	*Bombycilla garrulus*
Cedar waxwing[3]	*B. cedrorum*
Northern shrike[3]	*Lanius excubitor*
Loggerhead shrike[3]	*L. ludovicianus*
European starling[3]	*Sturnus vulgaris*
Solitary vireo	*Vireo solitarius*
Warbling vireo	*V. gilvus*
Red-eyed vireo[3]	*V. olivaceus*
Tennessee warbler	*Vermivora peregrina*
Orange-crowned warbler[3]	*V. celata*
Virginia's warbler[3]	*V. virginiae*
Yellow warbler[3]	*Dendroica petechia*
Yellow-rumped warbler[3]	*D. coronata*
Black-throated gray warbler	*D. nigrescens*
Townsend's warbler[3]	*D. townsendi*
Blackpoll warbler	*D. striata*
Black-and-white warbler	*Mniotilta varia*
American redstart	*Setophaga ruticilla*
Ovenbird	*Seiurus aurocapillus*
Northern waterthrush	*S. noveboracensis*
MacGillivray's warbler[3]	*Oporornis tolmiei*
Common yellowthroat	*Geothlypis trichas*
Wilson's warbler[3]	*Wilsonia pusilla*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Yellow-breasted chat	*Icteria virens*
Western tanager[3]	*Piranga ludoviciana*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Black-headed grosbeak[3]	*P. melanocephalus*
Blue grosbeak[3]	*Guiraca caerulea*
Lazuli bunting[3]	*Passerina amoena*
Indigo bunting	*P. cyanea*
Dickcissel	*Spiza americana*
Green-tailed towhee[3]	*Pipilo chlorurus*
Rufous-sided towhee[3]	*P. erythrophthalmus*
Cassin's sparrow[3]	*Aimophila cassinii*
American tree sparrow[3]	*Spizella arborea*
Chipping sparrow[3]	*S. passerina*
Clay-colored sparrow[3]	*S. pallida*
Brewer's sparrow[3]	*S. breweri*
Vesper sparrow[3]	*Pooecetes gramineus*
Lark sparrow[3]	*Chondestes grammacus*
Black-throated sparrow	*Amphispiza bilineata*
Sage sparrow[3]	*A. belli*
Lark bunting[3]	*Calamospiza melanocorys*
Savannah sparrow[3]	*Passerculus sandwichensis*
Baird's sparrow	*Ammodramus bairdii*
Grasshopper sparrow	*A. savannarum*
Fox sparrow	*Passerella iliaca*
Song sparrow[3]	*Melospiza melodia*
Lincoln's sparrow	*M. lincolnii*
White-throated sparrow[3]	*Zonotrichia albicollis*
White-crowned sparrow[3]	*Z. leucophrys*
Dark-eyed junco[3]	*Junco hyemalis*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
McCown's longspur[3]	*Calcarius mccownii*
Lapland longspur	*C. lapponicus*
Chestnut-collared longspur	*C. ornatus*
Snow bunting	*Plectrophenax nivalis*
Bobolink[3]	*Dolichonyx oryzivorus*
Red-winged blackbird[3]	*Agelaius phoeniceus*
Western meadowlark[3]	*Sturnella neglecta*
Yellow-headed blackbird[3]	*Xanthocephalus xanthocephalus*
Rusty blackbird	*Euphagus carolinus*
Brewer's blackbird[3]	*E. cyanocephalus*
Common grackle[3]	*Quiscalus quiscula*
Brown-headed cowbird[3]	*Molothrus ater*
Orchard oriole[3]	*Icterus spurius*
Northern oriole[3]	*I. galbula*
Rosy finch[3]	*Leucosticte arctoa*
Pine grosbeak	*Pinicola enucleator*
Purple finch[3]	*Carpodacus purpureus*
Cassin's finch[3]	*C. cassinii*
House finch[3]	*C. mexicanus*
Red crossbill	*Loxia curvirostra*
Common redpoll	*Carduelis flammea*
Pine siskin[3]	*C. pinus*
Lesser goldfinch	*C. psaltria*
American goldfinch[3]	*C. tristis*
Evening grosbeak	*Coccothraustes vespertinus*
House sparrow[3]	*Passer domesticus*

Animal Species Known to Occur or Potentially Occurring Within the KPPA[1] (Continued)

Common Name	Scientific Name
Amphibians and Reptiles[5]	
Tiger salamander	*Ambystoma tigrinum*
Wyoming toad	*Bufo hemiophrys baxteri*
Leopard frog	*Rana pipiens*
Chorus frog	*Pseudacris triseriata*
Sagebrush lizard	*Sceloporus graciosus*
Easten short-horned lizard[3]	*Phrynosoma douglassi brevirostre*
Western terrestrial garter snake	*Thamnophis elegans*
Fish[6]	
Common carp	*Cyprinus carpio*
Emerald shiner	*Notropis atherinoides*
Sand shiner	*N. stramineus*
Longnose dace	*Rhinichthys cataractae*
Creek chub	*Semotilus atromaculatus*
Longnose sucker	*Catostomus catostomus*
White sucker	*C. commersoni*
Cutthroat trout (Yellowstone subspecies)	*Oncorhynchus clarki*
Rainbow trout	*O. mykiss*
Brown trout[3]	*Salmo trutta*
Brook trout[3]	*Salvelinus fontinalis*
Johnny darter	*Etheostoma nigrum*
Walleye	*Stizostedion vitreum*

1 Based on range, habitat characteristics, and actual field observations.
2 Adapted from Clark and Stromberg (1987), WGFD (1992), and Mariah (1994a).
3 Species observed within or immediately adjacent to the KPPA during field surveys in 1994.
4 Adapted from Scott (1987), Russell (1990), WGFD (1992), and Mariah (1994a).
5 Adapted from Stebbins (1966), Baxter and Stone (1985), and Smith and Brodie (1982).
6 Adapted from Baxter and Simon (1970), Oberholtzer (1985), and American Fisheries Society (1991).

APPENDIX E:

SOCIOECONOMIC DATA

Animal Species Known or Likely to Occur [illegible]

Common Name	Scientific Name
Amphibians and Reptiles[a]	
Tiger salamander	*Ambystoma tigrinum*
Woodhouse toad	*Bufo woodhousei woodhousei*
Leopard frog	*Rana pipiens*
Chorus frog	*Pseudacris triseriata*
Sagebrush lizard	*Sceloporus graciosus*
Short-horned lizard	*Phrynosoma douglassi* [illegible]
Western terrestrial garter snake	*Thamnophis elegans*
Fish[f]	
Common carp	*Cyprinus carpio*
Emerald shiner	*Notropis atherinoides*
Sand shiner	*N. stramineus*
Longnose dace	*Rhinichthys cataractae*
Creek chub	*Semotilus atromaculatus*
Longnose sucker	*Catostomus catostomus*
White sucker	*C. commersoni*
Cutthroat trout (Yellowstone subspecies)	*Oncorhynchus clarki*
Rainbow trout	*O. mykiss*
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Johnny darter	*Etheostoma nigrum*
Walleye	*Stizostedion vitreum*

a Based on range, habitat characteristics, and recent field observations.
b Adapted from Clark and Stromberg (1987), WGFD (1992), and [illegible] (1986).
c Species observed visibly or [illegible] in the [illegible] during field [illegible].
d Adapted from [illegible] (1987), [illegible] (1988), WGFD (1992), and [illegible].
e Adapted from [illegible] (1980), [illegible] and [illegible] (1987), and Smith and [illegible].
f Adapted from Baxter and Simon (1970), [illegible] (1990), and American Fisheries Society (1991).

Table E1 Trades Utilized in Construction and Operation of the Windplant, 1995-2034.

Job Classification	Number of Employees 1995 Quarters				Number of Employees 1996 Quarters				Number of Employees 1997 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	7	7	0	0	5	5	0	0	5	5	0
Cement finisher	0	2	2	0	0	1	1	0	0	1	1	0
Cement, rebar	0	3	3	0	0	2	2	0	0	2	2	0
Electrician, helper	0	18	18	0	0	12	12	0	0	12	12	0
Electrician, industrial	0	12	12	0	0	8	8	0	0	8	8	0
Electrician, master	0	2	2	0	0	1	1	0	0	1	1	0
Laborer	0	42	42	0	0	30	30	0	0	30	30	0
Structural steel worker	0	18	18	0	0	12	12	0	0	12	12	0
Backhoe operator	0	3	3	0	0	2	2	0	0	2	2	0
Cherry picker operator	0	8	8	0	0	6	6	0	0	6	6	0
Cable crane operator	0	5	5	0	0	4	4	0	0	4	4	0
Dozer operator	0	2	2	0	0	1	1	0	0	1	1	0
Power shovel operator	0	2	2	0	0	1	1	0	0	1	1	0
Road roller operator	0	2	2	0	0	1	1	0	0	1	1	0
Transmission line												
Foreman	0	7	7	0	–	–	–	–	–	–	–	–
Lineman	0	8	8	0	–	–	–	–	–	–	–	–
Equipment operator	0	7	7	1	–	–	–	–	–	–	–	–
Laborer	0	4	4	0	–	–	–	–	–	–	–	–
Wireman	0	9	9	0	–	–	–	–	–	–	–	–
Total Construction Workers	0	161	161	1	0	86	86	0	0	86	86	0
O&M												
Windsmith	9	9	9	9	11	11	11	11	13	13	13	13
Grand Total	9	170	170	10	11	97	97	11	13	99	99	13

Table E1 (Continued)

	Number of Employees 1998 Quarters				Number of Employees 1999 Quarters				Number of Employees 2000 Quarters			
Job Classification	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	5	5	0	0	5	5	0	0	5	5	0
Cement finisher	0	1	1	0	0	1	1	0	0	1	1	0
Cement, rebar	0	2	2	0	0	2	2	0	0	2	2	0
Electrician, helper	0	12	12	0	0	12	12	0	0	12	12	0
Electrician, industrial	0	8	8	0	0	8	8	0	0	8	8	0
Electrician, master	0	1	1	0	0	1	1	0	0	1	1	0
Laborer	0	30	30	0	0	30	30	0	0	30	30	0
Structural steel worker	0	12	12	0	0	12	12	0	0	12	12	0
Backhoe operator	0	2	2	0	0	2	2	0	0	2	2	0
Cherry picker operator	0	6	6	0	0	6	6	0	0	6	6	0
Cable crane operator	0	4	4	0	0	4	4	0	0	4	4	0
Dozer operator	0	1	1	0	0	1	1	0	0	1	1	0
Power shovel operator	0	1	1	0	0	1	1	0	0	1	1	0
Road roller operator	0	1	1	0	0	1	1	0	0	1	1	0
Transmission line												
Foreman	–	–	–	–	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–	–	–	–	–
Total Construction Workers	0	86	86	0	0	86	86	0	0	86	86	0
O&M												
Windsmith	15	15	15	15	17	17	17	17	20	20	20	20
Grand Total	15	101	101	15	17	103	103	17	20	106	106	20

Table E1 (Continued)

Job Classification	2001 1st	2001 2nd	2001 3rd	2001 4th	2002 1st	2002 2nd	2002 3rd	2002 4th	2003 1st	2003 2nd	2003 3rd	2003 4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	5	5	0	0	5	5	0	0	5	5	0
Cement finisher	0	1	1	0	0	1	1	0	0	1	1	0
Cement, rebar	0	2	2	0	0	2	2	0	0	2	2	0
Electrician, helper	0	12	12	0	0	12	12	0	0	12	12	0
Electrician, industrial	0	8	8	0	0	8	8	0	0	8	8	0
Electrician, master	0	1	1	0	0	1	1	0	0	1	1	0
Laborer	0	30	30	0	0	30	30	0	0	30	30	0
Structural steel worker	0	12	12	0	0	12	12	0	0	12	12	0
Backhoe operator	0	2	2	0	0	2	2	0	0	2	2	0
Cherry picker operator	0	6	6	0	0	6	6	0	0	6	6	0
Cable crane operator	0	4	4	0	0	4	4	0	0	4	4	0
Dozer operator	0	1	1	0	0	1	1	0	0	1	1	0
Power shovel operator	0	1	1	0	0	1	1	0	0	1	1	0
Road roller operator	0	1	1	0	0	1	1	0	0	1	1	0
Transmission line												
Foreman	–	–	–	–	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–	–	–	–	–
Total Construction Workers	0	86	86	0	0	86	86	0	0	86	86	0
O&M												
Windsmith	22	22	22	22	25	25	25	25	27	27	27	27
Grand Total	22	108	108	22	25	111	111	25	27	113	113	27

Table E1 (Continued)

Job Classification	Number of Employees 2004 Quarters 1st	2nd	3rd	4th	Number of Employees 2005-2034 Quarters 1st	2nd	3rd	4th
CONSTRUCTION								
Windplant								
Carpenter/form setter	0	5	5	0	–	–	–	–
Cement finisher	0	1	1	0	–	–	–	–
Cement, rebar	0	2	2	0	–	–	–	–
Electrician, helper	0	12	12	0	–	–	–	–
Electrician, industrial	0	8	8	0	–	–	–	–
Electrician, master	0	1	1	0	–	–	–	–
Laborer	0	30	30	0	–	–	–	–
Structural steel worker	0	12	12	0	–	–	–	–
Backhoe operator	0	2	2	0	–	–	–	–
Cherry picker operator	0	6	6	0	–	–	–	–
Cable crane operator	0	4	4	0	–	–	–	–
Dozer operator	0	1	1	0	–	–	–	–
Power shovel operator	0	1	1	0	–	–	–	–
Road roller operator	0	1	1	0	–	–	–	–
Transmission line								
Foreman	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–
Total Construction Workers	0	86	86	0	–	–	–	–
O&M								
Windsmith	29	29	29	29	29	29	29	29
Grand Total	29	115	115	29	29	29	29	29

Table E2 Locally Hired Windplant Employees, Projections 1995-2034.[1]

Job Classification	Number of Employees 1995 Quarters				Number of Employees 1996 Quarters				Number of Employees 1997 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	6	6	0	0	4	4	0	0	4	4	0
Cement finisher	0	2	2	0	0	1	1	0	0	1	1	0
Cement, rebar	0	3	3	0	0	2	2	0	0	2	2	0
Electrician, helper	0	16	16	0	0	11	11	0	0	11	11	0
Electrician, industrial	0	6	6	0	0	6	6	0	0	6	6	0
Electrician, master	0	2	2	0	0	1	1	0	0	1	1	0
Laborer	0	38	38	0	0	27	27	0	0	27	27	0
Structural steel worker	0	14	14	0	0	11	11	0	0	11	11	0
Backhoe operator	0	3	3	0	0	2	2	0	0	2	2	0
Cherry picker operator	0	2	2	0	0	2	2	0	0	2	2	0
Cable crane operator	0	4	4	0	0	4	4	0	0	4	4	0
Dozer operator	0	2	2	0	0	1	1	0	0	1	1	0
Power shovel operator	0	2	2	0	0	1	1	0	0	1	1	0
Road roller operator	0	2	2	0	0	1	1	0	0	1	1	0
Transmission line												
Foreman	0	1	1	0	–	–	–	–	–	–	–	–
Lineman	0	1	1	0	–	–	–	–	–	–	–	–
Equipment operator	0	6	6	1	–	–	–	–	–	–	–	–
Laborer	0	4	4	0	–	–	–	–	–	–	–	–
Wireman	0	1	1	0	–	–	–	–	–	–	–	–
Total Construction Workers	0	115	115	1	0	74	74	0	0	74	74	0
O&M												
Windsmith	8	8	8	9	10	10	10	10	12	12	12	12
Grand Total	8	123	123	10	10	84	84	10	12	86	86	12

[1] Locally hired Windplant employees are those employees who were residents of Carbon or Albany County during the previous year. Projections based on assumed 90% use of available local labor force.

Table E2 (Continued)

Job Classification	Number of Employees 1998 Quarters 1st	2nd	3rd	4th	Number of Employees 1999 Quarters 1st	2nd	3rd	4th	Number of Employees 2000 Quarters 1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	4	4	0	0	4	4	0	0	4	4	0
Cement finisher	0	1	1	0	0	1	1	0	0	1	1	0
Cement, rebar	0	2	2	0	0	2	2	0	0	2	2	0
Electrician, helper	0	11	11	0	0	11	11	0	0	11	11	0
Electrician, industrial	0	6	6	0	0	6	6	0	0	6	6	0
Electrician, master	0	1	1	0	0	1	1	0	0	1	1	0
Laborer	0	27	27	0	0	27	27	0	0	27	27	0
Structural steel worker	0	11	11	0	0	11	11	0	0	11	11	0
Backhoe operator	0	2	2	0	0	2	2	0	0	2	2	0
Cherry picker operator	0	2	2	0	0	2	2	0	0	2	2	0
Cable crane operator	0	4	4	0	0	4	4	0	0	4	4	0
Dozer operator	0	1	1	0	0	1	1	0	0	1	1	0
Power shovel operator	0	1	1	0	0	1	1	0	0	1	1	0
Road roller operator	0	1	1	0	0	1	1	0	0	1	1	0
Transmission line												
Foreman	–	–	–	–	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–	–	–	–	–
Total Construction Workers	0	74	74	0	0	74	74	0	0	74	74	0
O&M												
Windsmith	14	14	14	14	15	15	15	15	18	18	18	18
Grand Total	14	88	88	14	15	89	89	15	18	92	92	18

Table E2 (Continued)

Job Classification	Number of Employees 2001 Quarters				Number of Employees 2002 Quarters				Number of Employees 2003 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	4	4	0	0	4	4	0	0	4	4	0
Cement finisher	0	1	1	0	0	1	1	0	0	1	1	0
Cement, rebar	0	2	2	0	0	2	2	0	0	2	2	0
Electrician, helper	0	11	11	0	0	11	11	0	0	11	11	0
Electrician, industrial	0	6	6	0	0	6	6	0	0	6	6	0
Electrician, master	0	1	1	0	0	1	1	0	0	1	1	0
Laborer	0	27	27	0	0	27	27	0	0	27	27	0
Structural steel worker	0	11	11	0	0	11	11	0	0	11	11	0
Backhoe operator	0	2	2	0	0	2	2	0	0	2	2	0
Cherry picker operator	0	2	2	0	0	2	2	0	0	2	2	0
Cable crane operator	0	4	4	0	0	4	4	0	0	4	4	0
Dozer operator	0	1	1	0	0	1	1	0	0	1	1	0
Power shovel operator	0	1	1	0	0	1	1	0	0	1	1	0
Road roller operator	0	1	1	0	0	1	1	0	0	1	1	0
Transmission line												
Foreman	–	–	–	–	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–	–	–	–	–
Total Construction Workers	0	74	74	0	0	74	74	0	0	74	74	0
O&M												
Windsmith	20	20	20	20	23	23	23	23	24	24	24	24
Grand Total	20	94	94	20	23	97	97	23	24	98	98	24

Table E2 (Continued)

Job Classification	Number of Employees 2004 Quarters 1st	2nd	3rd	4th	Number of Employees 2005-2034 Quarters 1st	2nd	3rd	4th
CONSTRUCTION								
Windplant								
Carpenter/form setter	0	4	4	0	–	–	–	–
Cement finisher	0	1	1	0	–	–	–	–
Cement, rebar	0	2	2	0	–	–	–	–
Electrician, helper	0	11	11	0	–	–	–	–
Electrician, industrial	0	6	6	0	–	–	–	–
Electrician, master	0	1	1	0	–	–	–	–
Laborer	0	27	27	0	–	–	–	–
Structural steel worker	0	11	11	0	–	–	–	–
Backhoe operator	0	2	2	0	–	–	–	–
Cherry picker operator	0	2	2	0	–	–	–	–
Cable crane operator	0	4	4	0	–	–	–	–
Dozer operator	0	1	1	0	–	–	–	–
Power shovel operator	0	1	1	0	–	–	–	–
Road roller operator	0	1	1	0	–	–	–	–
Transmission line								
Foreman	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–
Total Construction Workers	0	74	74	0	–	–	–	–
O&M								
Windsmith	26	26	26	26	26	26	26	26
Grand Total	26	100	100	26	26	26	26	26

Table E3 In-migrant Windplant Employees, Projections 1995-2034.[1]

	Number of Employees 1995 Quarters				Number of Employees 1996 Quarters				Number of Employees 1997 Quarters			
Job Classification	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	1	1	0	0	1	1	0	0	1	1	0
Cement finisher	0	0	0	0	0	0	0	0	0	0	0	0
Cement, rebar	0	0	0	0	0	0	0	0	0	0	0	0
Electrician, helper	0	2	2	0	0	1	1	0	0	1	1	0
Electrician, industrial	0	6	6	0	0	2	2	0	0	2	2	0
Electrician, master	0	0	0	0	0	0	0	0	0	0	0	0
Laborer	0	4	4	0	0	3	3	0	0	3	3	0
Structural steel worker	0	4	4	0	0	1	1	0	0	1	1	0
Backhoe operator	0	0	0	0	0	0	0	0	0	0	0	0
Cherry picker operator	0	6	6	0	0	4	4	0	0	4	4	0
Cable crane operator	0	1	1	0	0	0	0	0	0	0	0	0
Dozer operator	0	0	0	0	0	0	0	0	0	0	0	0
Power shovel operator	0	0	0	0	0	0	0	0	0	0	0	0
Road roller operator	0	0	0	0	0	0	0	0	0	0	0	0
Transmission line												
Foreman	0	6	6	0	–	–	–	–	–	–	–	–
Lineman	0	7	7	0	–	–	–	–	–	–	–	–
Equipment operator	0	1	1	0	–	–	–	–	–	–	–	–
Laborer	0	0	0	0	–	–	–	–	–	–	–	–
Wireman	0	8	8	0	–	–	–	–	–	–	–	–
Total Construction Workers	0	46	46	1	0	12	12	0	0	12	12	0
O&M												
Windsmith	1	1	1	1	1	1	1	1	1	1	1	1
Grand Total	1	47	47	2	1	13	13	1	1	13	13	1

[1] In-migrant Windplant employees are those employees who were not residents of Albany or Carbon County during the previous year. Projections based on assumed 90% use of available local labor force.

Table E3 (Continued)

Job Classification	Number of Employees 1998 Quarters 1st	2nd	3rd	4th	Number of Employees 1999 Quarters 1st	2nd	3rd	4th	Number of Employees 2000 Quarters 1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	1	1	0	0	1	1	0	0	1	1	0
Cement finisher	0	0	0	0	0	0	0	0	0	0	0	0
Cement, rebar	0	0	0	0	0	0	0	0	0	0	0	0
Electrician, helper	0	1	1	0	0	1	1	0	0	1	1	0
Electrician, industrial	0	2	2	0	0	2	2	0	0	2	2	0
Electrician, master	0	0	0	0	0	0	0	0	0	0	0	0
Laborer	0	3	3	0	0	3	3	0	0	3	3	0
Structural steel worker	0	1	1	0	0	1	1	0	0	1	1	0
Backhoe operator	0	0	0	0	0	0	0	0	0	0	0	0
Cherry picker operator	0	4	4	0	0	4	4	0	0	4	4	0
Cable crane operator	0	0	0	0	0	0	0	0	0	0	0	0
Dozer operator	0	0	0	0	0	0	0	0	0	0	0	0
Power shovel operator	0	0	0	0	0	0	0	0	0	0	0	0
Road roller operator	0	0	0	0	0	0	0	0	0	0	0	0
Transmission line												
Foreman	–	–	–	–	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–	–	–	–	–
Total Construction Workers	0	12	12	0	0	12	12	0	0	12	12	0
O&M												
Windsmith	1	1	1	1	2	2	2	2	2	2	2	2
Grand Total	1	13	13	1	2	14	14	2	2	14	14	2

Table E3 (Continued)

Job Classification	Number of Employees 2001 Quarters				Number of Employees 2002 Quarters				Number of Employees 2003 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION												
Windplant												
Carpenter/form setter	0	1	1	0	0	1	1	0	0	1	1	0
Cement finisher	0	0	0	0	0	0	0	0	0	0	0	0
Cement, rebar	0	0	0	0	0	0	0	0	0	0	0	0
Electrician, helper	0	1	1	0	0	1	1	0	0	1	1	0
Electrician, industrial	0	2	2	0	0	2	2	0	0	2	2	0
Electrician, master	0	0	0	0	0	0	0	0	0	0	0	0
Laborer	0	3	3	0	0	3	3	0	0	3	3	0
Structural steel worker	0	1	1	0	0	1	1	0	0	1	1	0
Backhoe operator	0	0	0	0	0	0	0	0	0	0	0	0
Cherry picker operator	0	4	4	0	0	4	4	0	0	4	4	0
Cable crane operator	0	0	0	0	0	0	0	0	0	0	0	0
Dozer operator	0	0	0	0	0	0	0	0	0	0	0	0
Power shovel operator	0	0	0	0	0	0	0	0	0	0	0	0
Road roller operator	0	0	0	0	0	0	0	0	0	0	0	0
Transmission line												
Foreman	–	–	–	–	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–	–	–	–	–
Total Construction Workers	0	12	12	0	0	12	12	0	0	12	12	0
O&M												
Windsmith	2	2	2	2	2	2	2	2	3	3	3	3
Grand Total	2	14	14	2	2	14	14	2	3	15	15	3

Table E3 (Continued)

Job Classification	Number of Employees 2004 Quarters				Number of Employees 2005-2034 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
CONSTRUCTION								
Windplant								
Carpenter/form setter	0	1	1	0	–	–	–	–
Cement finisher	0	0	0	0	–	–	–	–
Cement, rebar	0	0	0	0	–	–	–	–
Electrician, helper	0	1	1	0	–	–	–	–
Electrician, industrial	0	2	2	0	–	–	–	–
Electrician, master	0	0	0	0	–	–	–	–
Laborer	0	3	3	0	–	–	–	–
Structural steel worker	0	1	1	0	–	–	–	–
Backhoe operator	0	0	0	0	–	–	–	–
Cherry picker operator	0	4	4	0	–	–	–	–
Cable crane operator	0	0	0	0	–	–	–	–
Dozer operator	0	0	0	0	–	–	–	–
Power shovel operator	0	0	0	0	–	–	–	–
Road roller operator	0	0	0	0	–	–	–	–
Transmission line								
Foreman	–	–	–	–	–	–	–	–
Lineman	–	–	–	–	–	–	–	–
Equipment operator	–	–	–	–	–	–	–	–
Laborer	–	–	–	–	–	–	–	–
Wireman	–	–	–	–	–	–	–	–
Total Construction Workers	0	12	12	0	–	–	–	–
O&M								
Windsmith	3	3	3	3	3	3	3	3
Grand Total	3	15	15	3	3	3	3	3

Table E4 Total and Average Payroll, 1995-2034.

	Construction Jobs		O&M Jobs		
Year	Average Salary for 6 Month Work Period	Total Annual Payroll	Average Annual Salary	Total Annual Payroll	Total Annual Payroll for All Employment
1995	$19,685	$3,169,285	$28,122	$253,094	$3,422,379
1996	$20,473	$1,750,635	$29,246	$321,711	$2,082,346
1997	$21,292	$1,831,069	$30,416	$395,412	$2,226,481
1998	$22,143	$1,904,298	$31,633	$474,495	$2,378,793
1999	$23,029	$1,980,494	$32,898	$559,271	$2,539,765
2000	$23,950	$2,059,700	$34,214	$684,285	$2,743,985
2001	$24,908	$2,142,088	$35,583	$782,821	$2,924,909
2002	$25,905	$2,227,787	$37,006	$925,153	$3,152,940
2003	$26,941	$2,316,883	$38,486	$1,039,131	$3,356,014
2004	$28,018	$2,409,548	$40,026	$1,160,748	$3,570,296
2005	–	–	$41,627	$1,207,178	$1,207,178
2006	–	–	$43,292	$1,255,465	$1,255,465
2007	–	–	$45,024	$1,305,684	$1,305,684
2008	–	–	$46,825	$1,357,911	$1,357,911
2009	–	–	$48,698	$1,412,228	$1,412,228
2010	–	–	$50,645	$1,468,717	$1,468,717
2011	–	–	$52,671	$1,527,466	$1,527,466
2012	–	–	$54,778	$1,588,564	$1,588,564
2013	–	–	$56,969	$1,652,107	$1,652,107
2014	–	–	$59,248	$1,718,191	$1,718,191
2015	–	–	$61,618	$1,786,919	$1,786,919
2016	–	–	$64,083	$1,858,396	$1,858,396
2017	–	–	$66,646	$1,932,731	$1,932,731
2018	–	–	$69,312	$2,010,041	$2,010,041
2019	–	–	$72,084	$2,090,442	$2,090,442
2020	–	–	$74,968	$2,174,060	$2,174,060
2021	–	–	$77,966	$2,261,022	$2,261,022
2022	–	–	$81,085	$2,351,463	$2,351,463
2023	–	–	$84,328	$2,445,522	$2,445,522
2024	–	–	$87,701	$2,543,343	$2,543,343
2025	–	–	$91,210	$2,645,076	$2,645,076

Table E4 (Continued)

	Construction Jobs		O&M Jobs		
Year	Average Salary for 6 Month Work Period	Total Annual Payroll	Average Annual Salary	Total Annual Payroll	Total Annual Payroll for All Employment
2026	–	–	$94,858	$2,750,879	$2,750,879
2027	–	–	$98,652	$2,860,915	$2,860,915
2028	–	–	$102,598	$2,975,351	$2,975,351
2029	–	–	$106,702	$3,094,365	$3,094,365
2030	–	–	$110,970	$3,218,140	$3,218,140
2031	–	–	$115,409	$3,346,865	$3,346,865
2032	–	–	$120,026	$3,480,740	$3,480,740
2033	–	–	$124,827	$3,619,970	$3,619,970
2034	–	–	$129,820	$3,764,768	$3,764,768
Total payroll 1995 through 2034					$96,102,427

Table E5 Sales and Property Taxes Paid by the Windplant, 1995-2034.

Year	Sales Tax	Property Tax	Portion of Property Tax Going to Schools (80.8% of Property Tax)
1995	--	--	--
1996	$1,760,604	$ 790,014	$ 638,331
1997	$1,831,028	$1,350,549	$1,091,244
1998	$1,904,269	$1,914,995	$1,547,316
1999	$1,980,440	$2,483,511	$2,006,677
2000	$2,059,657	$3,056,258	$2,469,456
2001	$2,142,044	$3,633,406	$2,935,792
2002	$2,227,725	$4,215,131	$3,405,826
2003	$2,316,834	$4,801,616	$3,879,706
2004	$1,445,705	$5,393,052	$4,357,586
2005	--	$5,668,369	$4,580,042
2006	--	$5,445,721	$4,400,143
2007	--	$5,223,072	$4,220,242
2008	--	$5,000,424	$4,040,343
2009	--	$4,777,776	$3,860,443
2010	--	$4,555,127	$3,680,543
2011	--	$4,332,479	$3,500,643
2012	--	$4,109,831	$3,320,743
2013	--	$3,887,182	$3,140,843
2014	--	$3,664,534	$2,960,943
2015	--	$3,441,886	$2,781,044
2016	--	$3,219,237	$2,601,143
2017	--	$2,996,589	$2,421,244
2018	--	$2,773,941	$2,241,344
2019	--	$2,551,292	$2,061,444
2020	--	$2,328,644	$1,881,544
2021	--	$2,105,996	$1,701,645
2022	--	$1,883,347	$1,521,744
2023	--	$1,660,699	$1,341,845
2024	--	$1,438,051	$1,161,945
2025	--	$1,215,402	$ 982,045
2026	--	$ 992,754	$ 802,145

Table E5 (Continued)

Year	Sales Tax	Property Tax	Portion of Property Tax Going to Schools (80.8% of Property Tax)
2027	–	$ 796,440	$ 643,524
2028	–	$ 619,687	$ 500,707
2029	–	$ 463,280	$ 374,330
2030	–	$ 328,031	$ 265,049
2031	–	$ 214,787	$ 173,548
2032	–	$ 124,428	$ 100,538
2033	–	$ 57,869	$ 46,758
2034	–	$ 16,063	$ 12,979

APPENDIX F:

VISUAL SIMULATIONS OF THE WINDPLANT

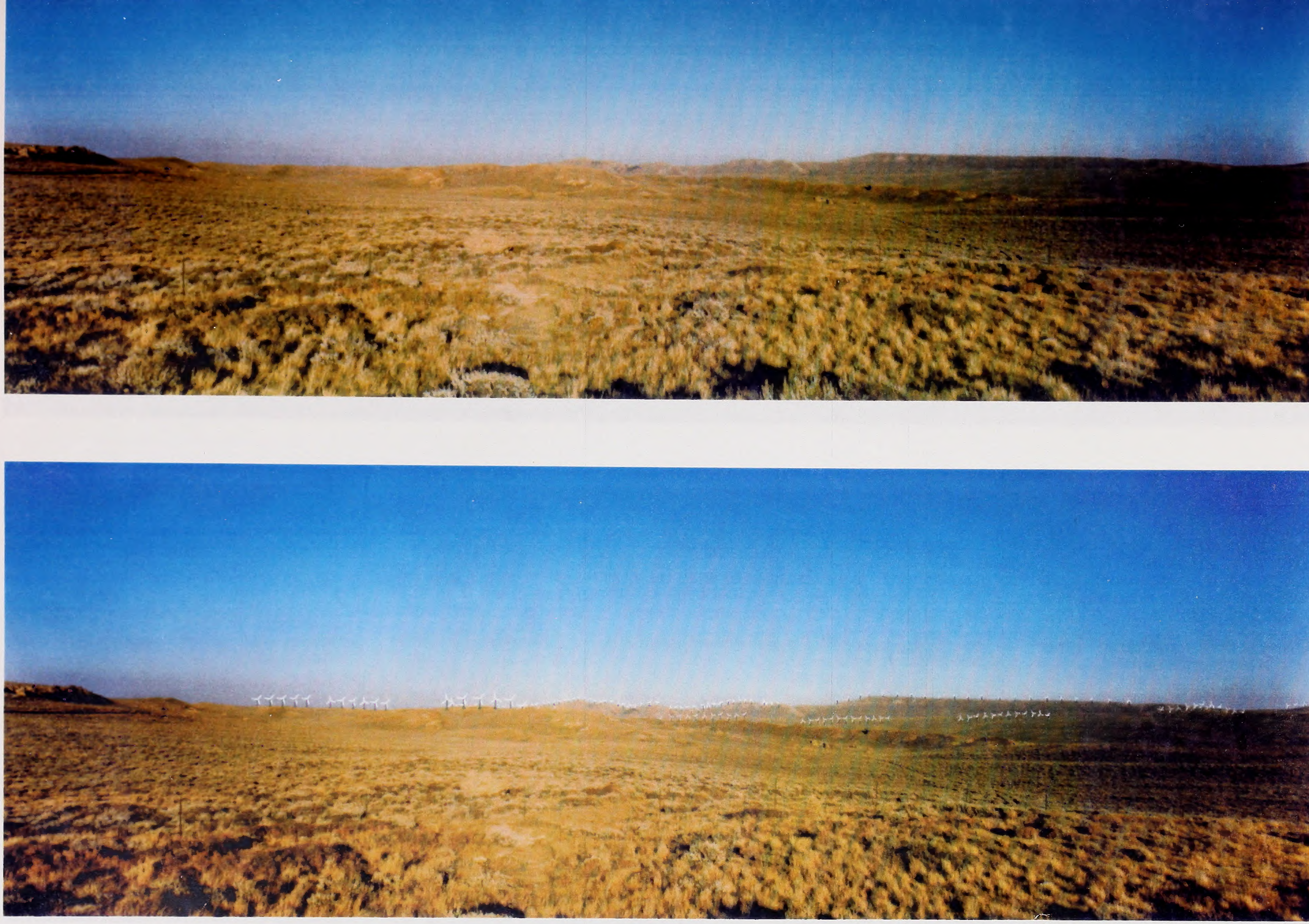
(The simulations in this appendix do not show other Windplant facilities or roads.)

Photograph F.1 KOP 1 - 1.5 mi (2.4 km) East of the Arlington Exit on I-80 Looking Northwest Towards Foote Creek Rim. Top is the Existing View; Bottom is a Simulation of the 200-MW Foote Creek Rim Portion of the Windplant as Seen from this Point.

Photograph F.2 KOP 2 - At the Arlington KOA Looking Northwest Towards Foote Creek Rim. Top is the Existing View; Bottom is a Simulation of the 200-MW Foote Creek Rim Portion of the Windplant as Seen from this Point.

Photograph F.3 KOP 3 - McFadden School Looking Northwest Towards Foote Creek Rim. Top is Existing View; Bottom is a Simulation of the 200-MW Foote Creek Rim Portion of the Windplant as Seen from this Point.

Photograph F.4 KOP 5 - 2.0 mi (3.2 km) West of Arlington on I-80 Looking East Towards Foote Creek Rim. Top is Existing View; Bottom is a Simulation of the 200-MW Foote Creek Rim Portion of the Windplant as Seen from this Point.



Photograph F.5 KOP 6 - In the Simpson Ridge Area 4.0 mi (6.4 km) Southeast of Hanna Junction on Highway 72 Looking East. Top is Existing View; Bottom is a Simulation of the 300-MW Simpson Ridge Portion of the Windplant as Seen from this Point.

Photograph F.6 KOP 7 - 5.0 mi (8.0 km) West of the Elk Mountain Exit on I-80, Looking North. Top is Existing View; Bottom is a Simulation of the 300-MW Simpson Ridge Portion of the Windplant as Seen from this Point.